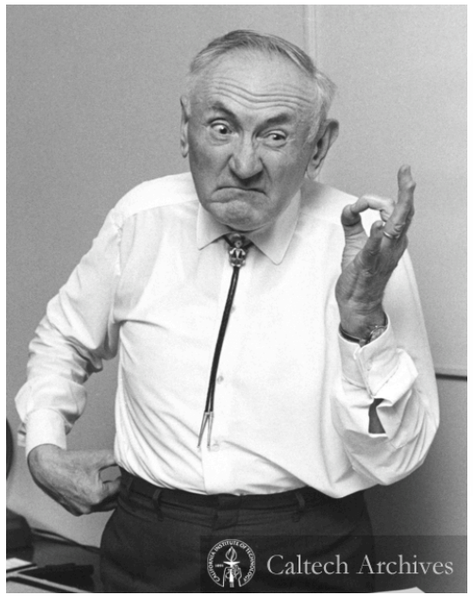
Intracluster Light:
a luminous tracer for dark matter in clusters of galaxies

UNSW SYDNEY

@mireiamontesq

Mireia Montes

In collaboration with: Ignacio Trujillo

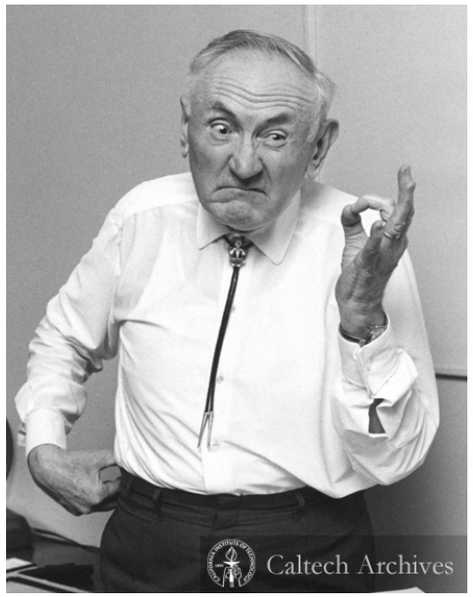


nebula!

Rotverschiebung extragalaktischer Nebel. 125

Um, wie beobachtet, einen mittleren Dopplereffekt von 1000 km/sek oder mehr zu erhalten, müsste also die mittlere Dichte im Comasystem mindestens 400 mal grösser sein als die auf Grund von Beobachtungen an leuchtender Materie abgeleitete[1]). Falls sich dies bewahrheiten sollte, würde sich also das überraschende Resultat ergeben, dass dunkle Materie in sehr viel grösserer Dichte vorhanden ist als leuchtende Materie.

Image credit: Javier Román



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If this should be verified, it would lead to the surprising result that dark matter exists in much greater density than luminous matter.

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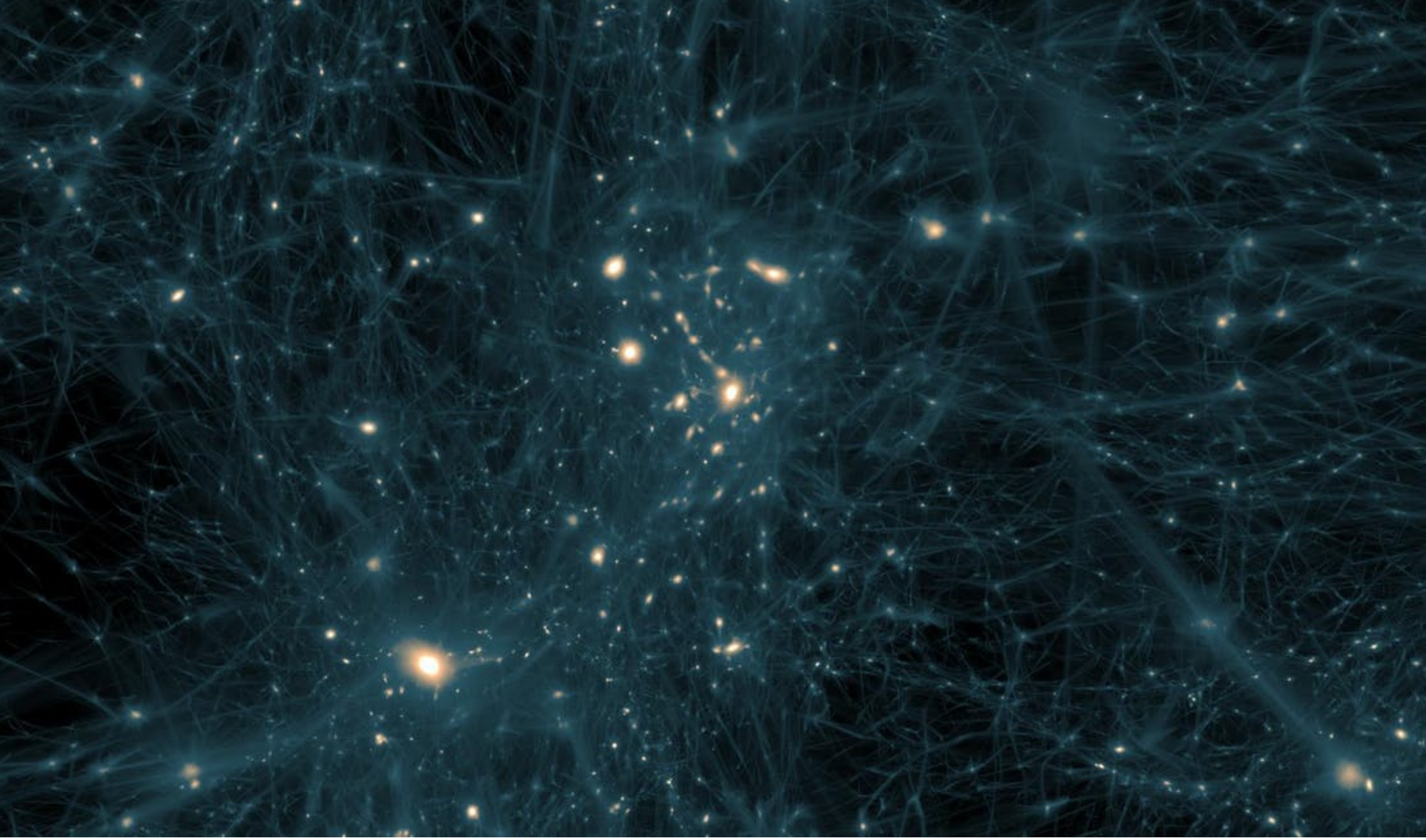
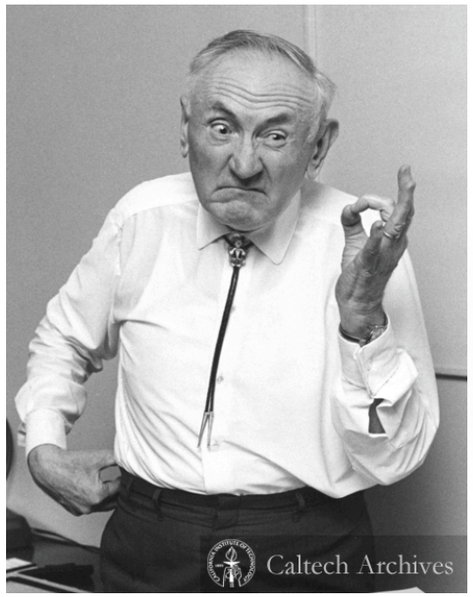


The elusive dark matter



Diffuse light proposed by Zwicky (1937)

field nebulae. In the second place, we should expect a considerable number of stars, as well as matter in dispersed form from disrupted nebulae, to be scattered through the internebular spaces within clusters. Sufficiently large amounts of internebular matter in clusters

and first observed by Zwicky (1951) in Coma

One of the most interesting discoveries made in the course of this investigation is the observation of an extended mass of luminous intergalactic matter of very low surface brightness. The objects which constitute this matter must be considered as the faintest individual members of the cluster. They indicate that the

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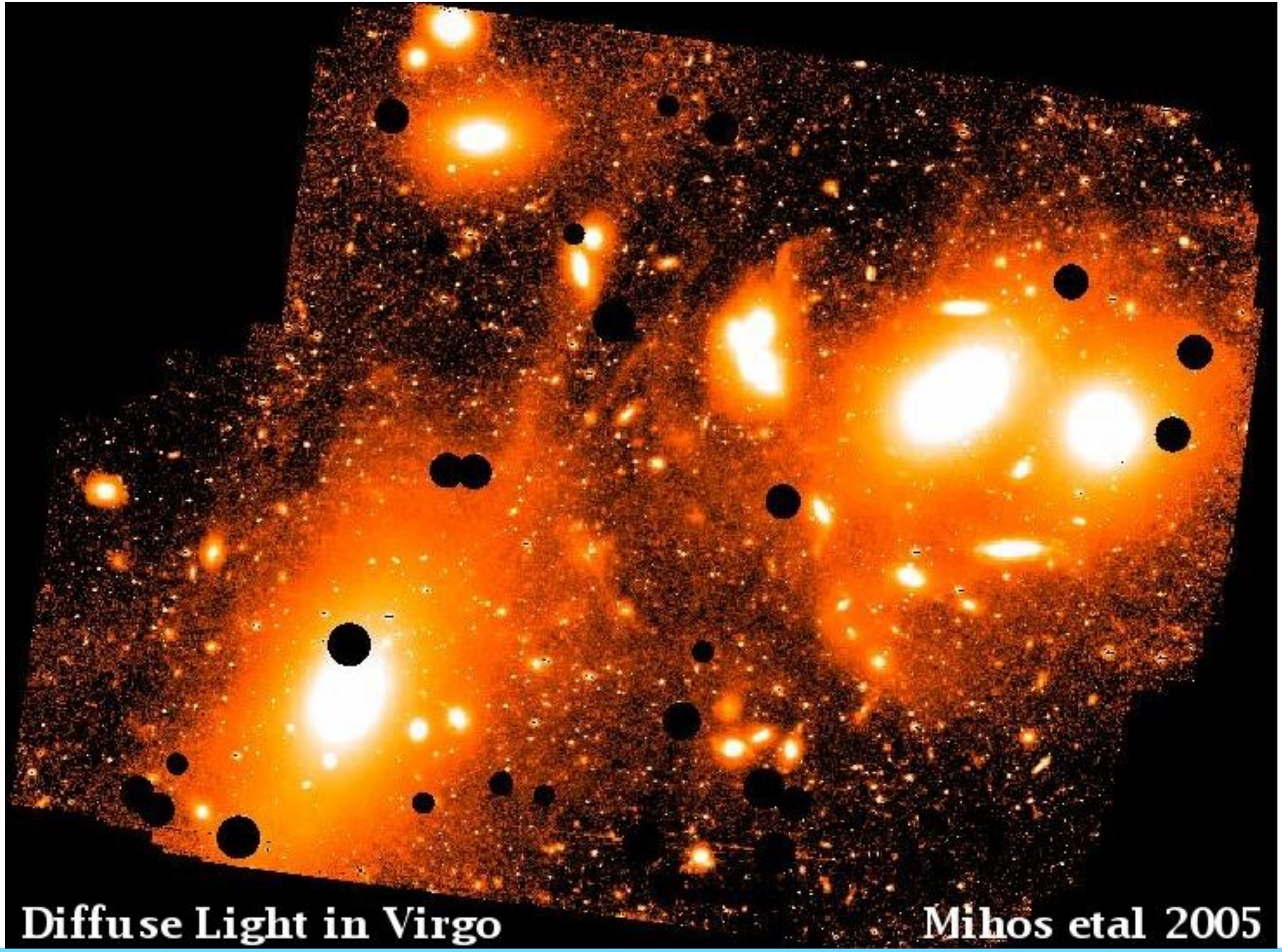
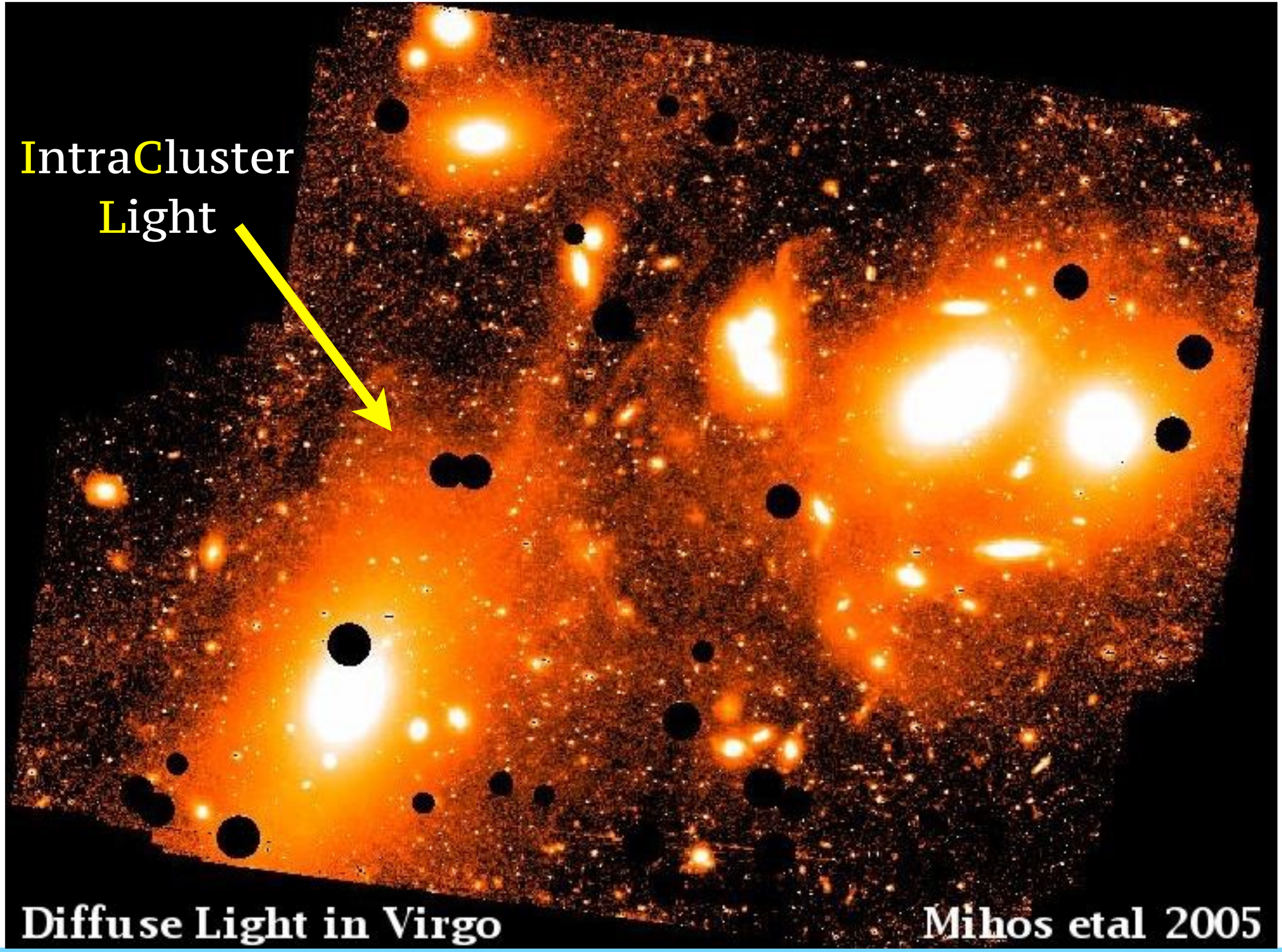
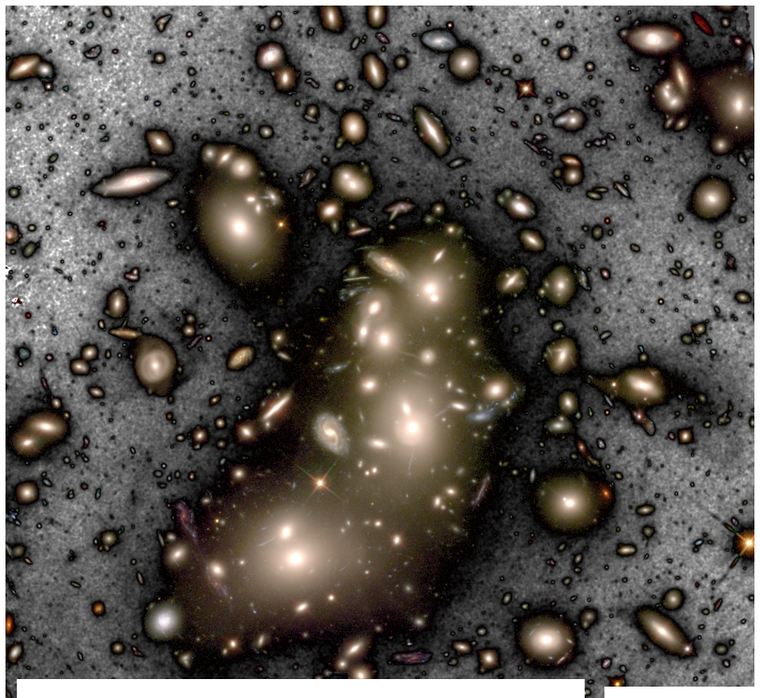

Diffuse Light in Virgo
Mihos etal 2005

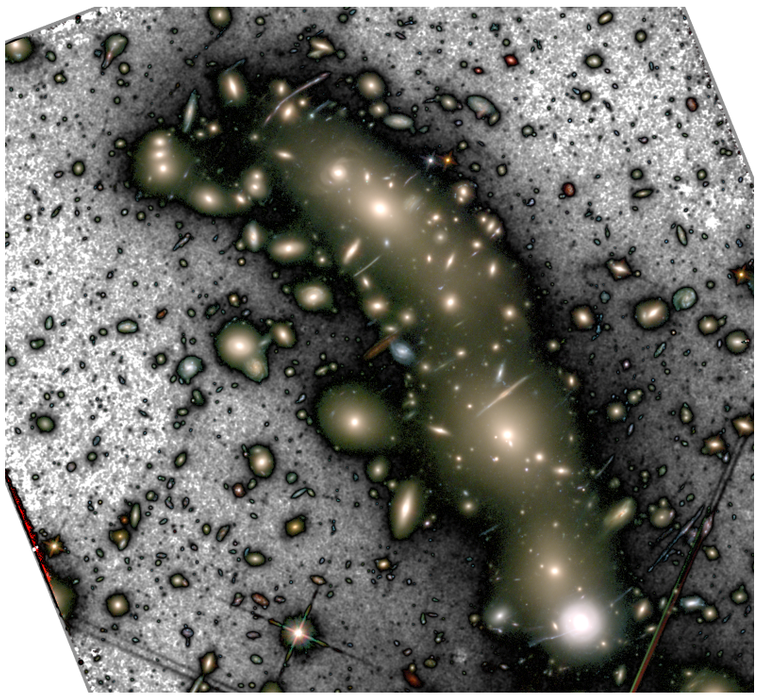

IntraCluster
Light
Diffuse Light in Virgo
Mihos etal 2005

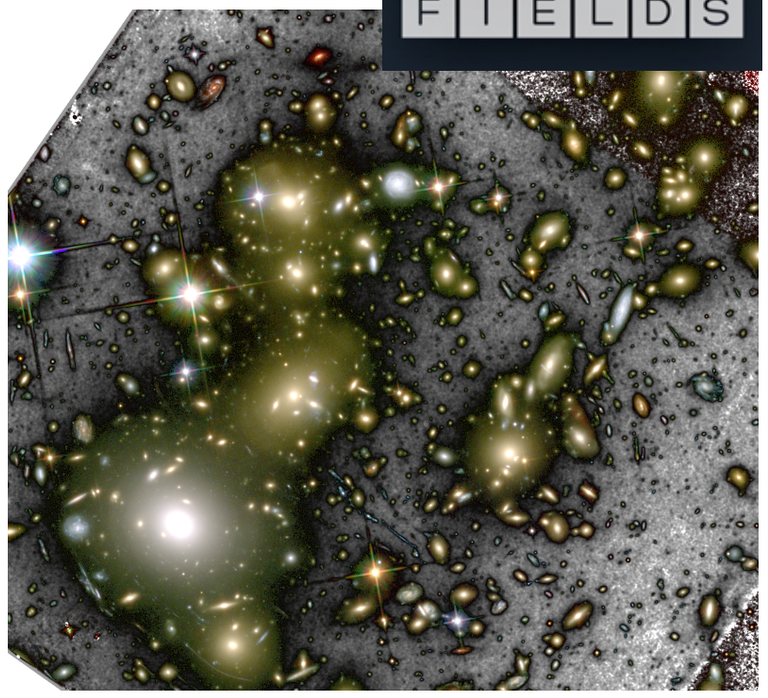
This is a video!!

This is a video!!

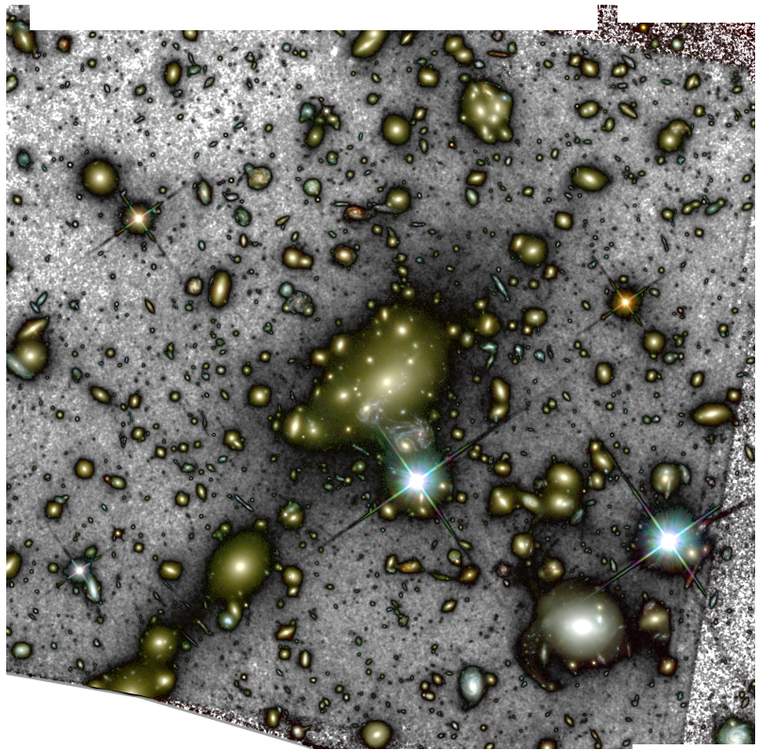
Hubble Frontier Fields

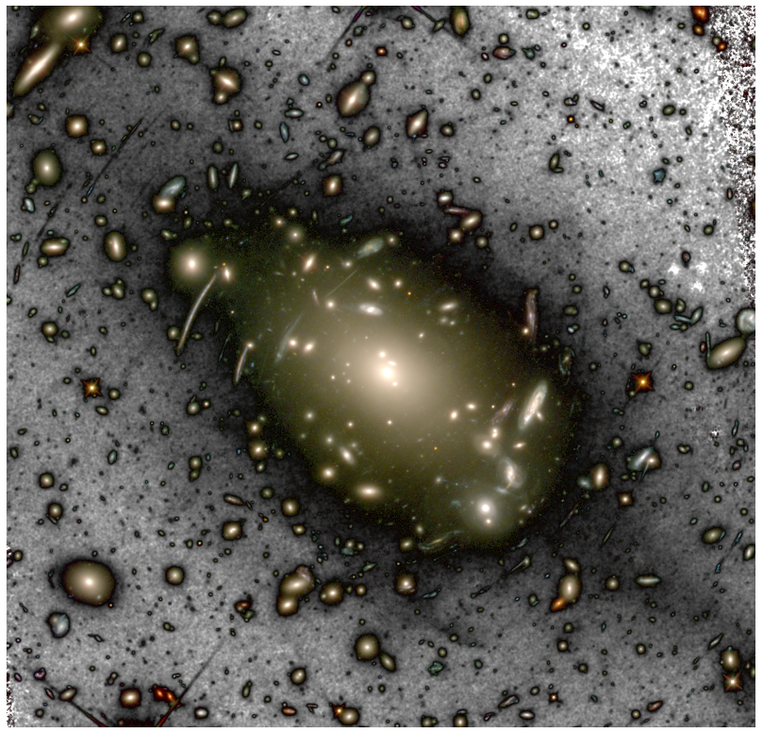


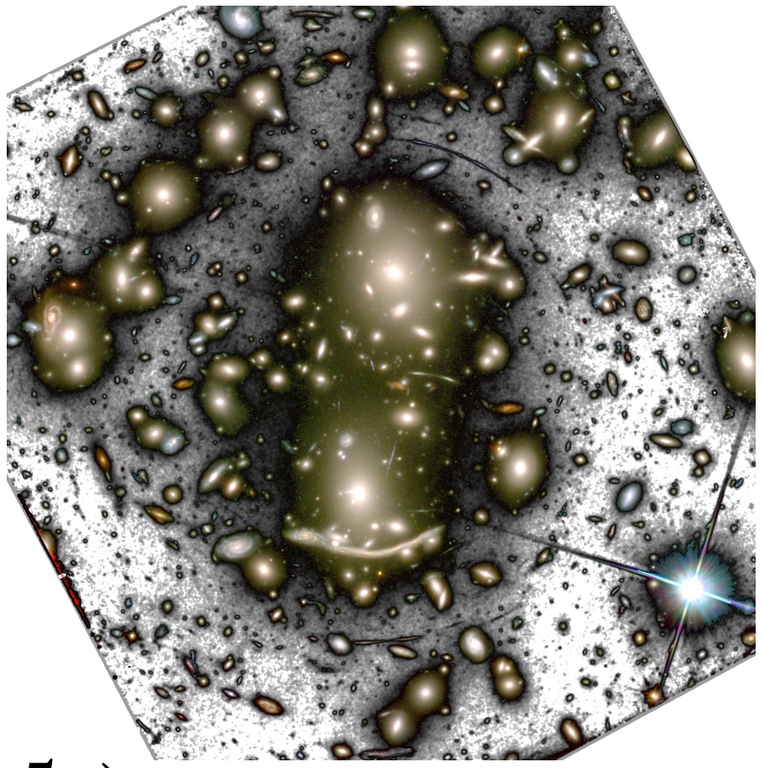




0.3 < z < 0.55 F435W, F606W, F814W, F105W, F125W, F140W, F160W

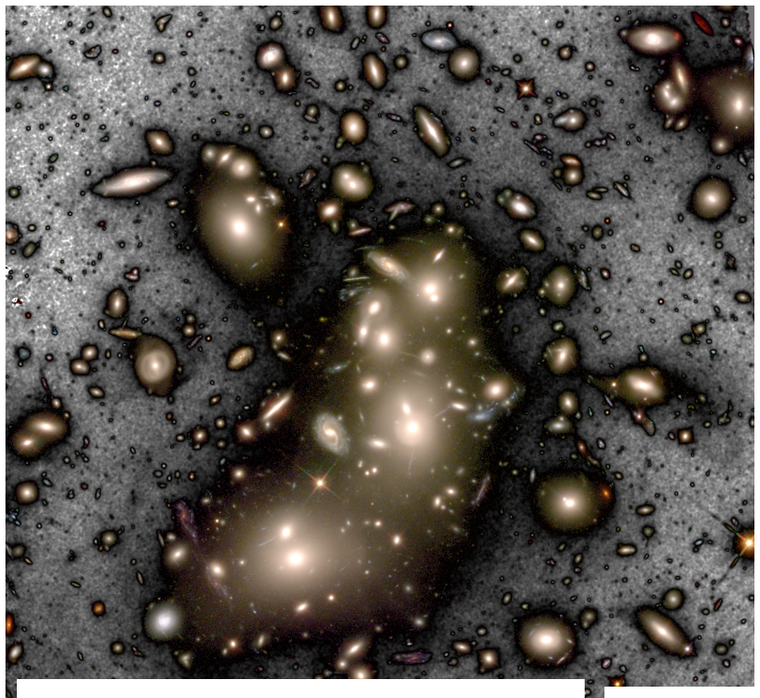


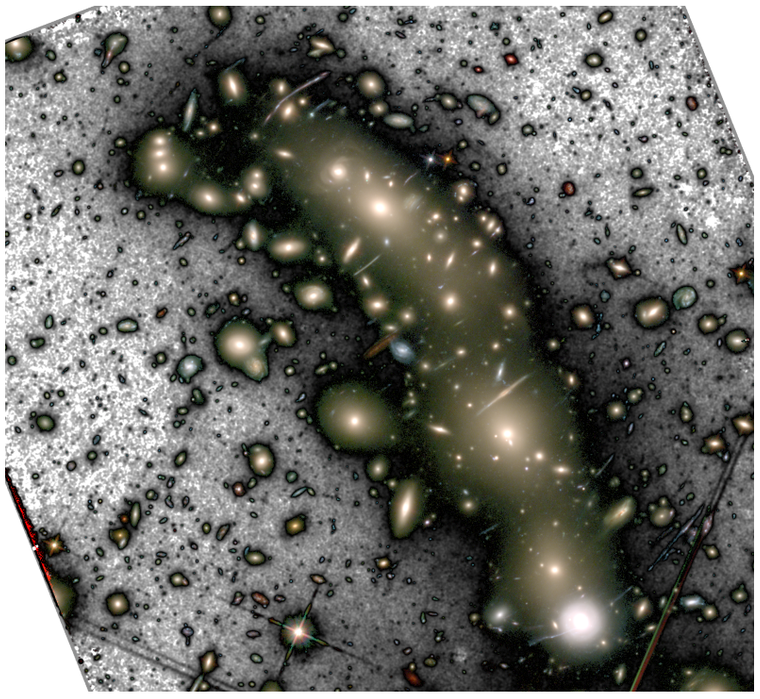


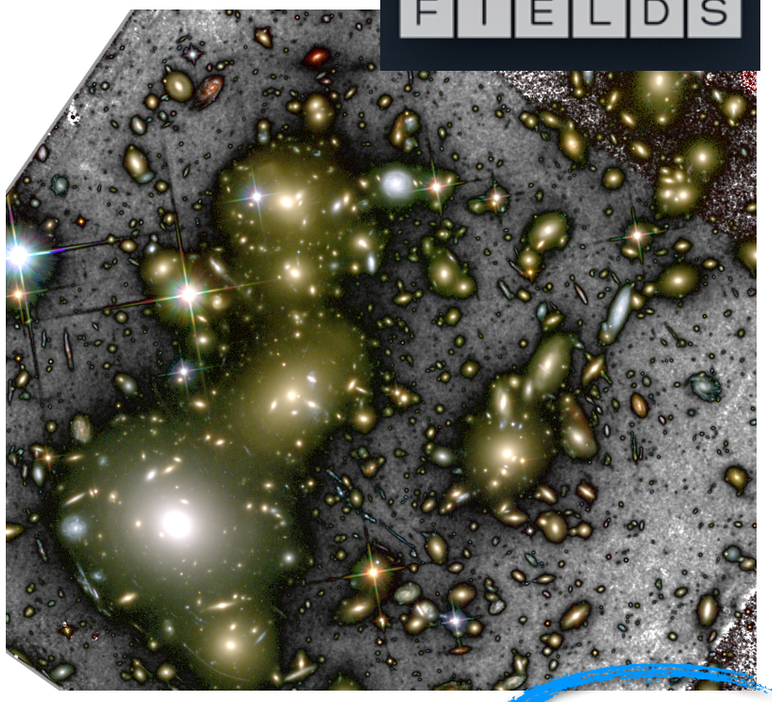


~31 mag/arcsec^2 (3x3 arcsec^2, 5σ)

Hubble Frontier Fields







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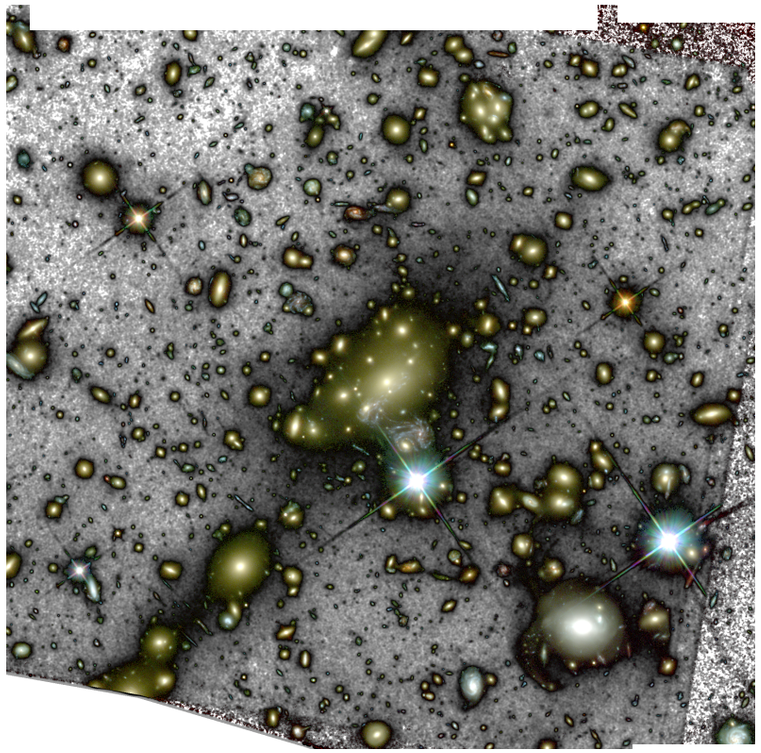

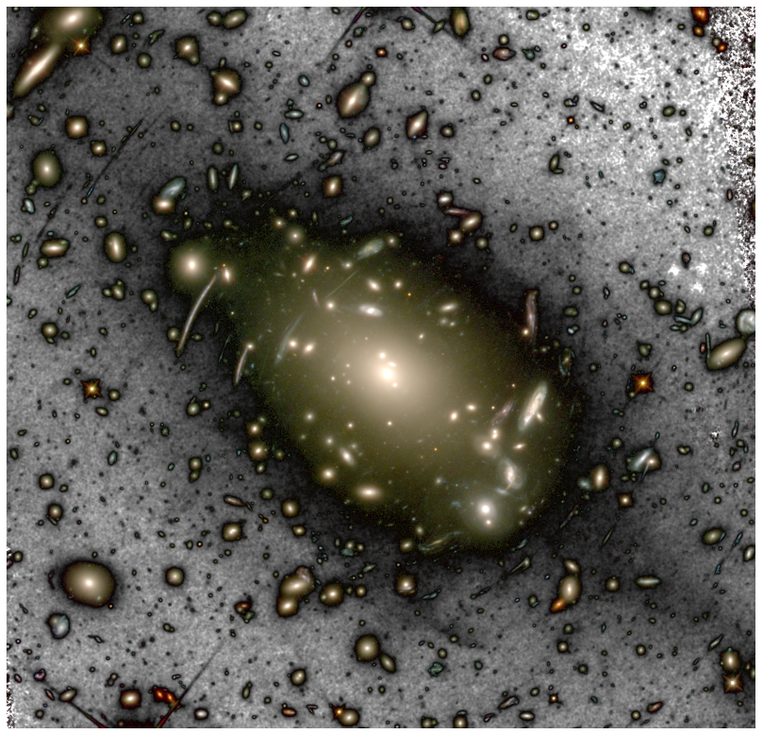

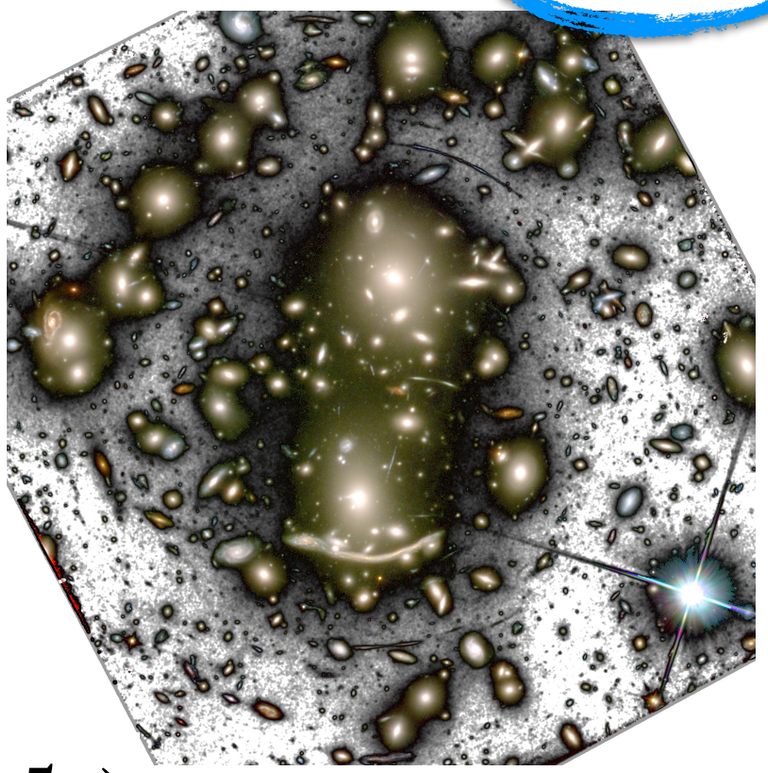

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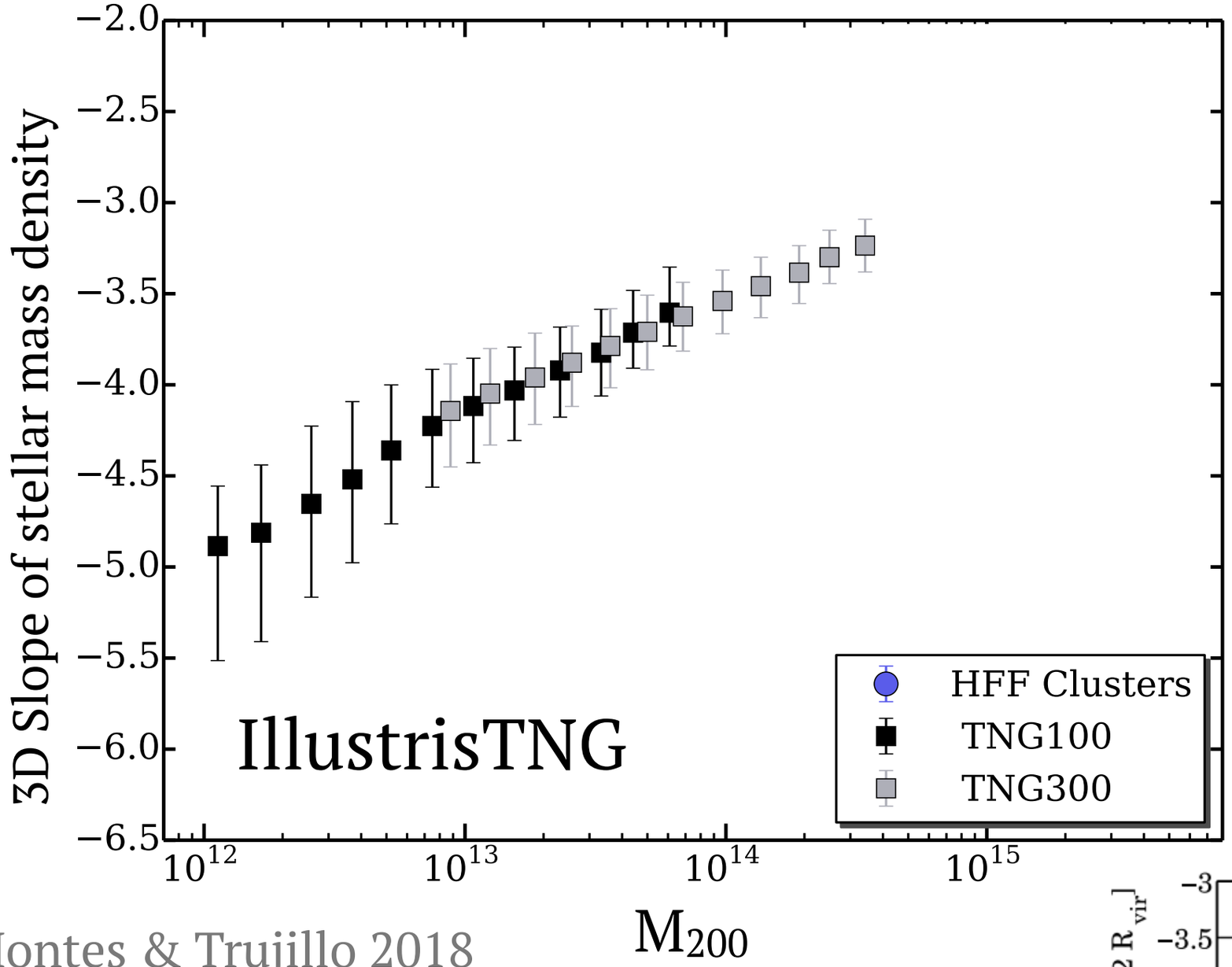
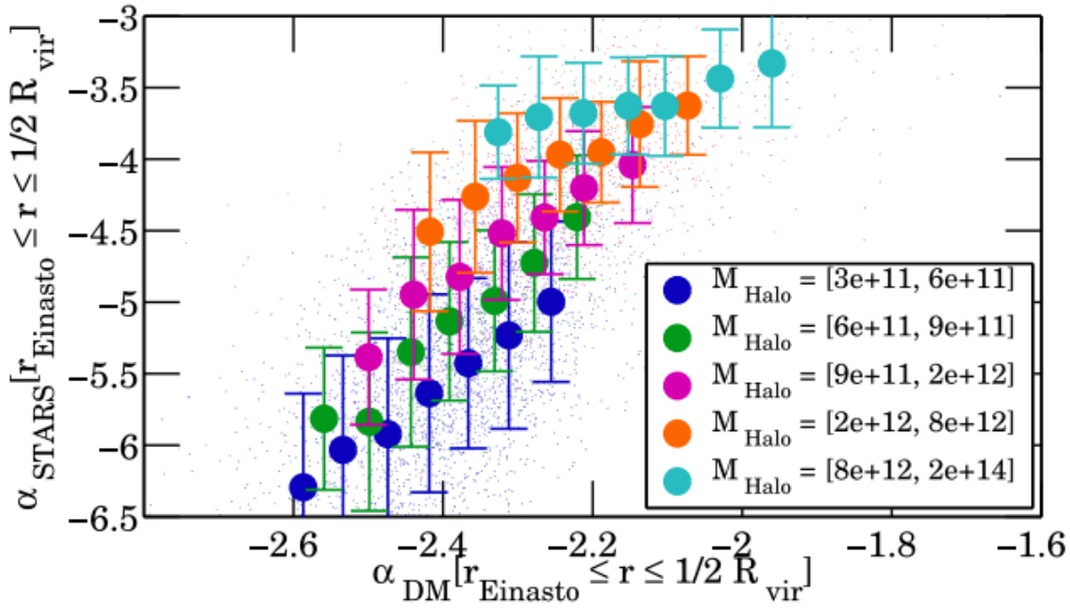


Montes & Trujillo 2018

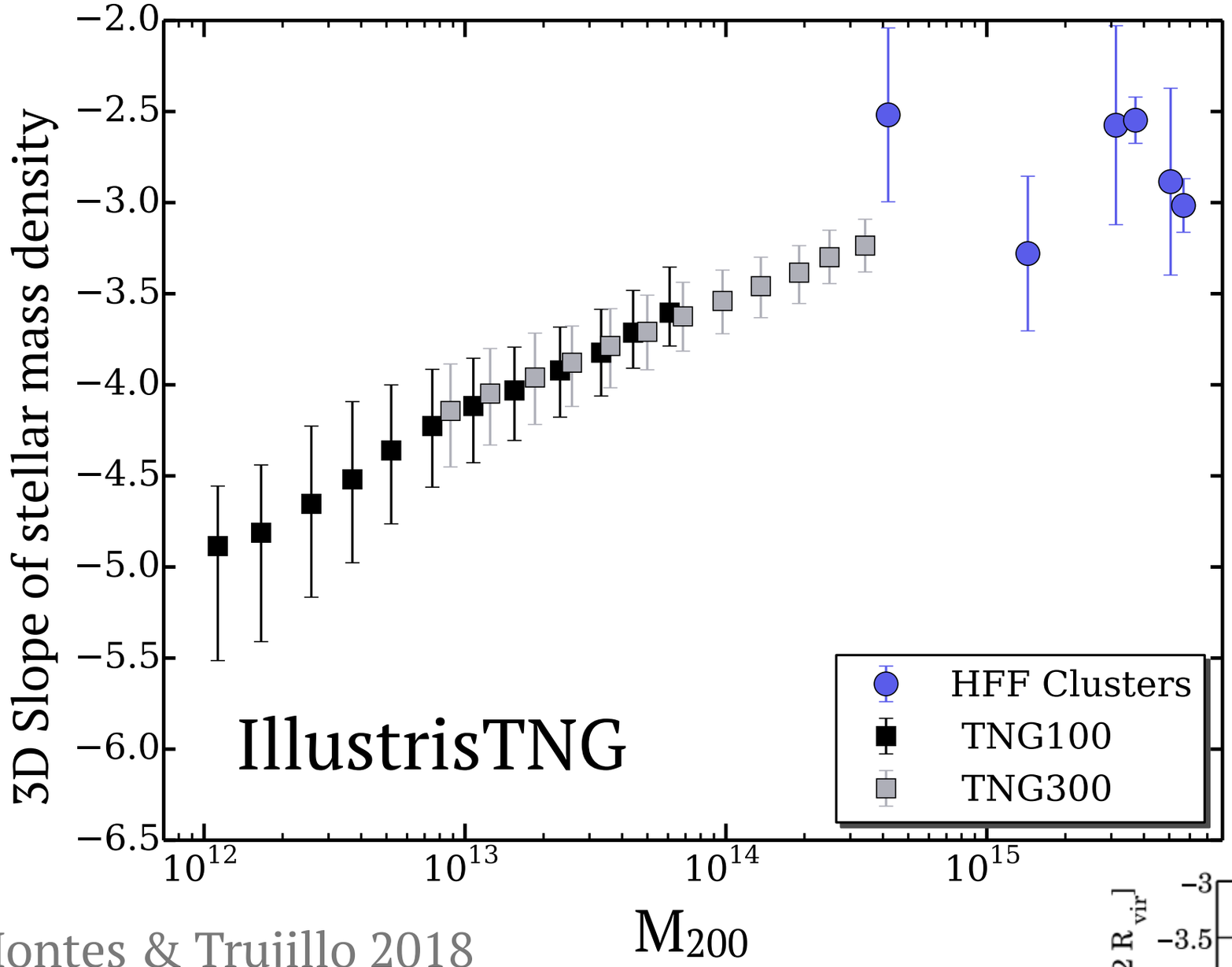
Slope of the stellar mass density profile of the halo (3D) correlates with the total halo mass

Pillepich+2014, 2018

slopes of the radial mass density distribution as shallow as the dark matter's!!



Pillepich+2014



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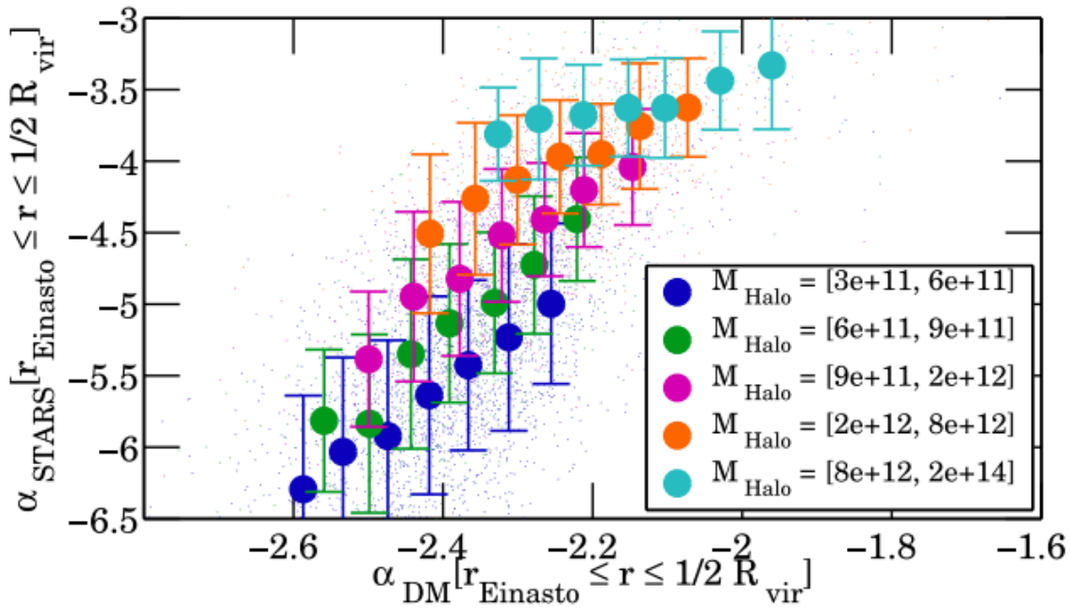
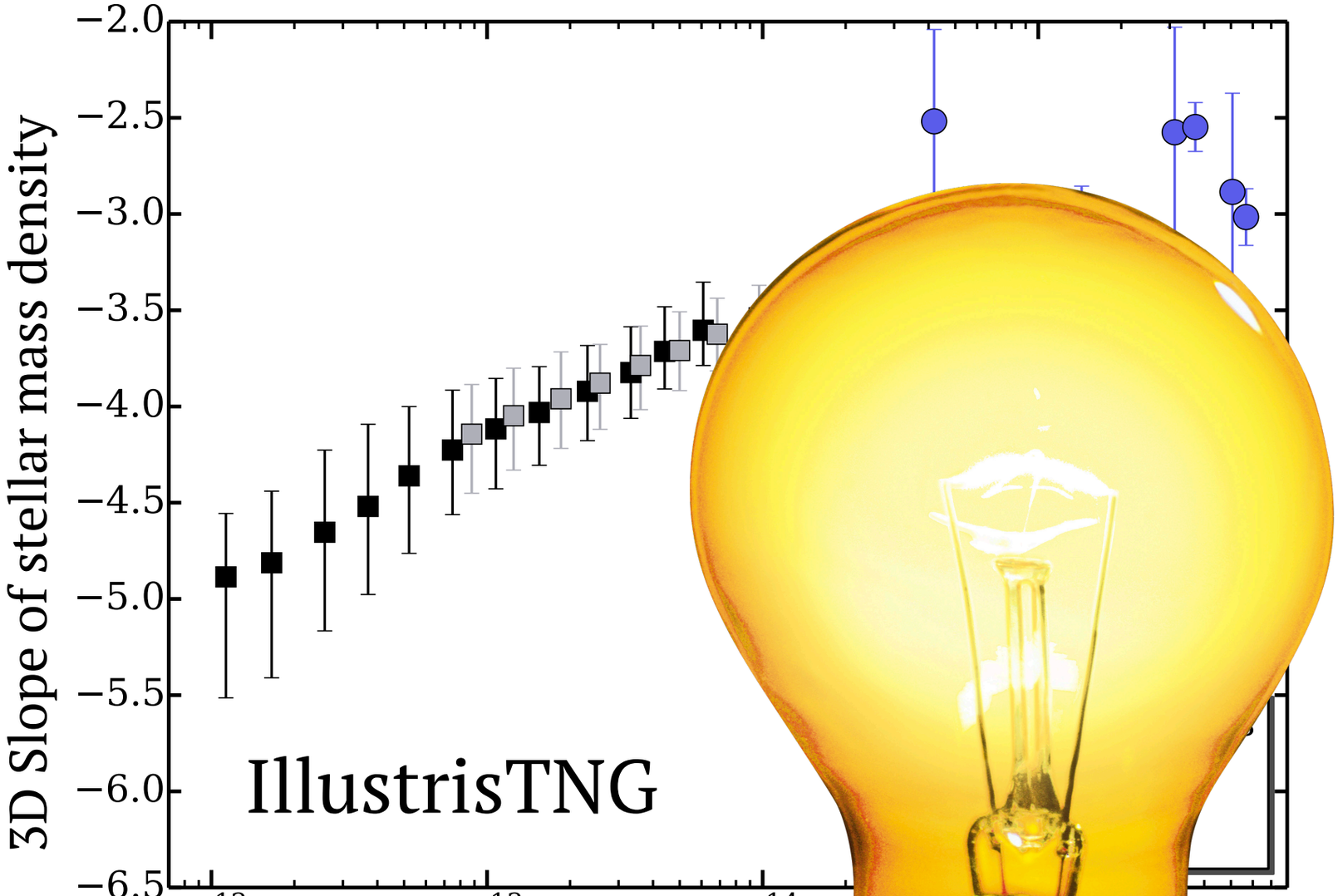
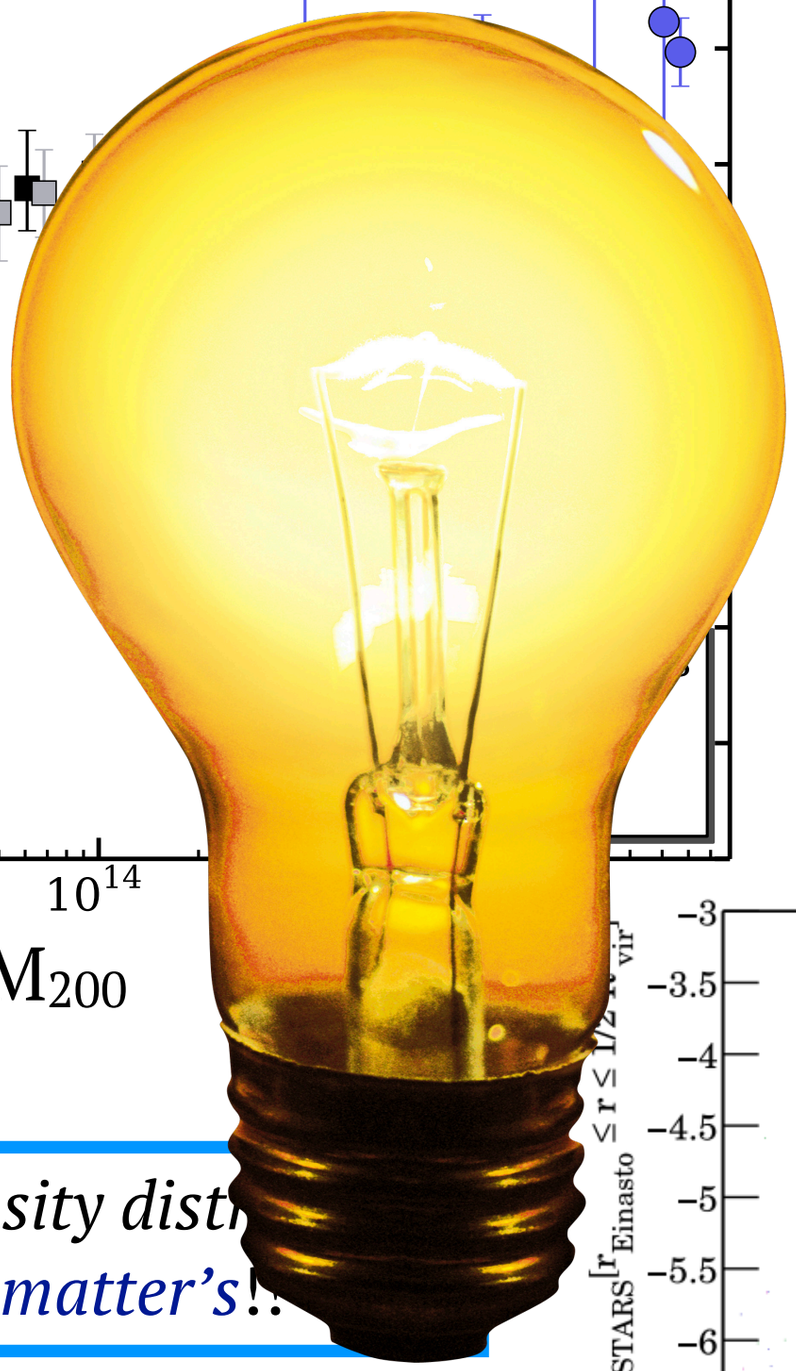


Pillepich+2014



Montes & Trujillo 2018



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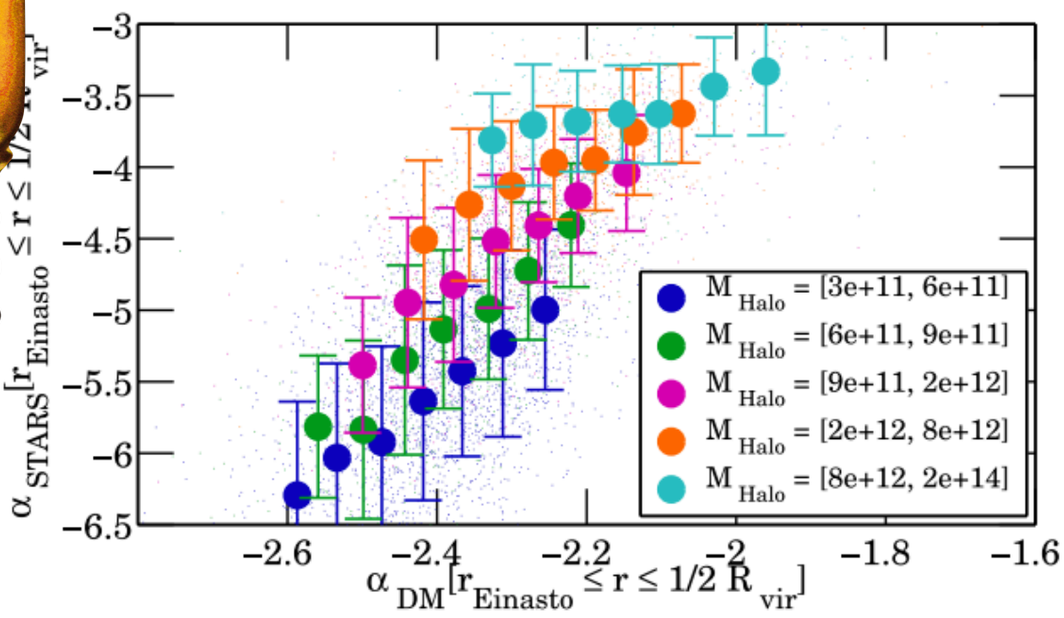

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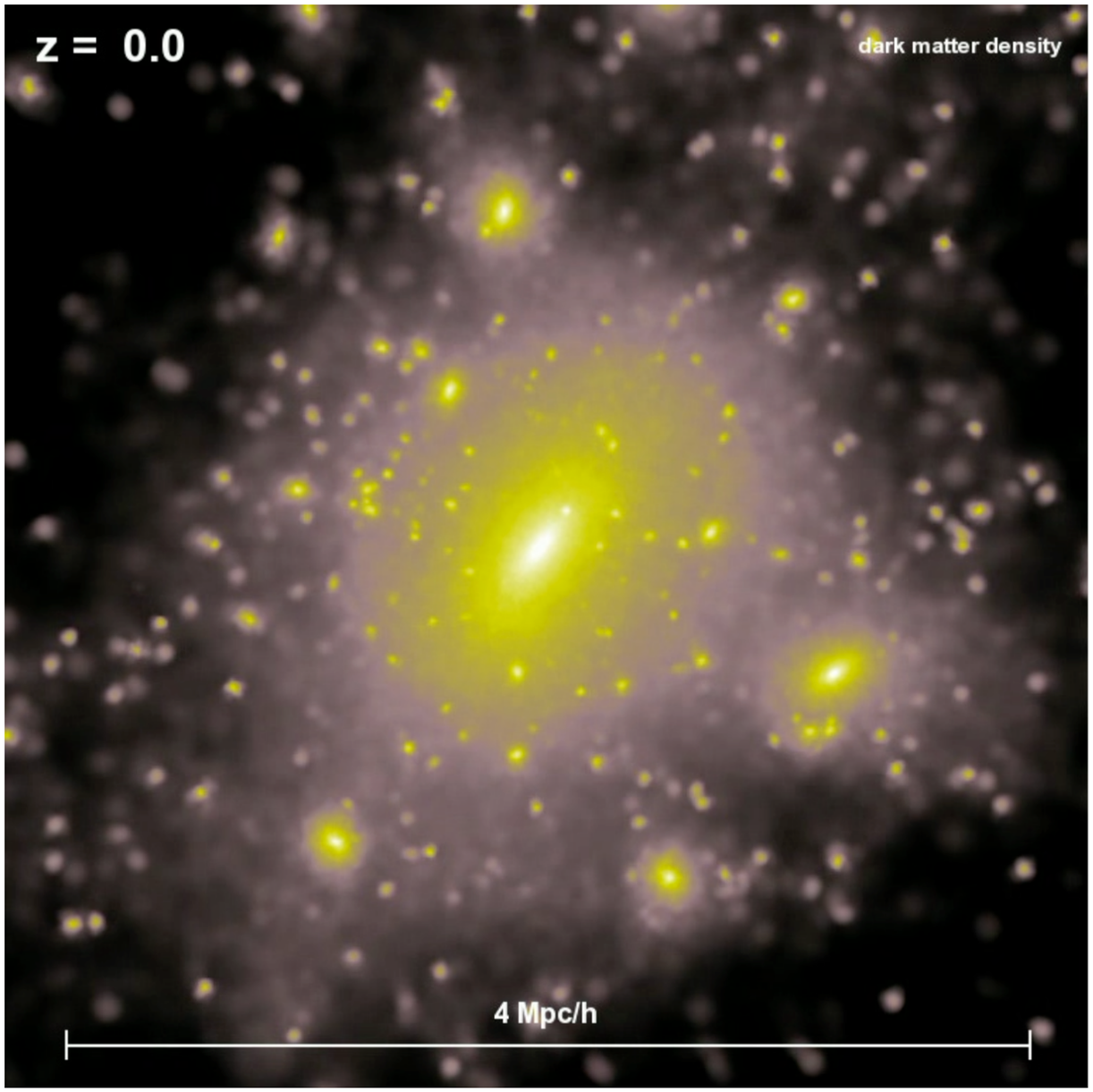
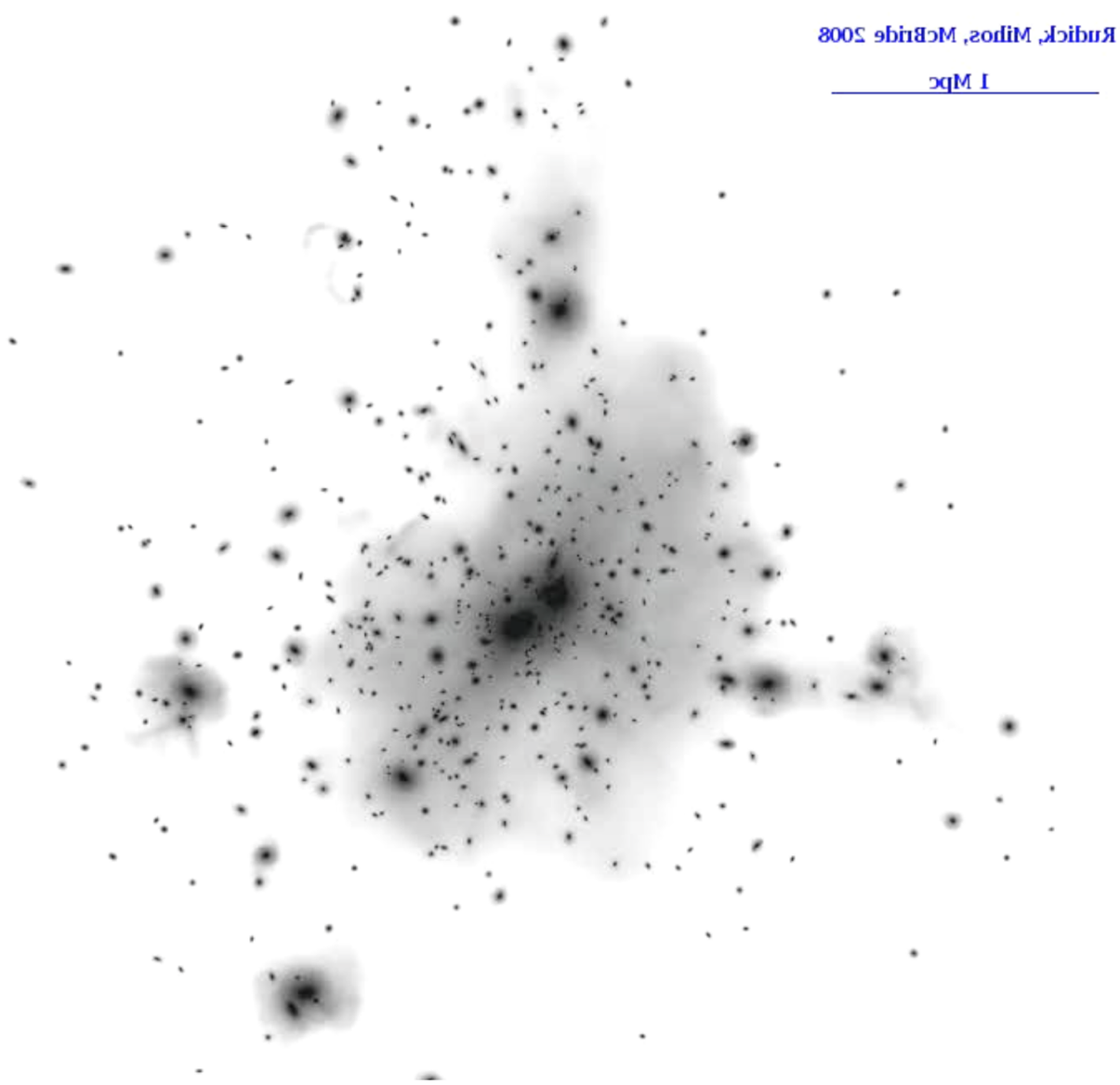
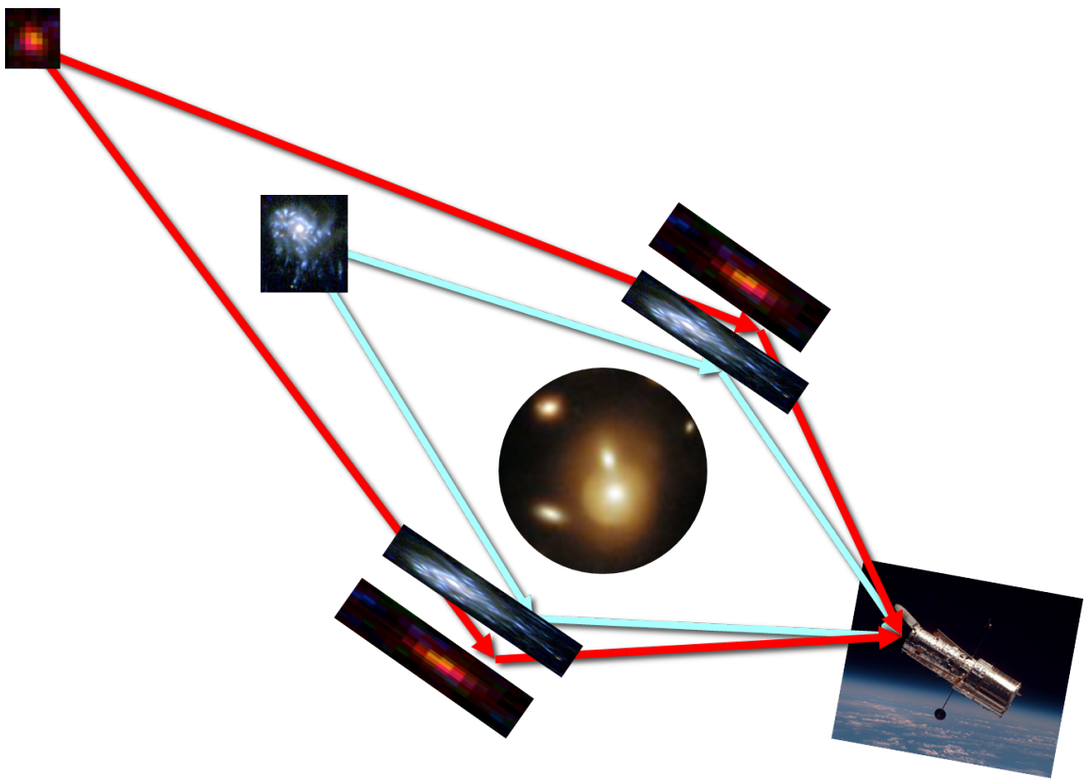


DM only



Stars

Gravitational lensing



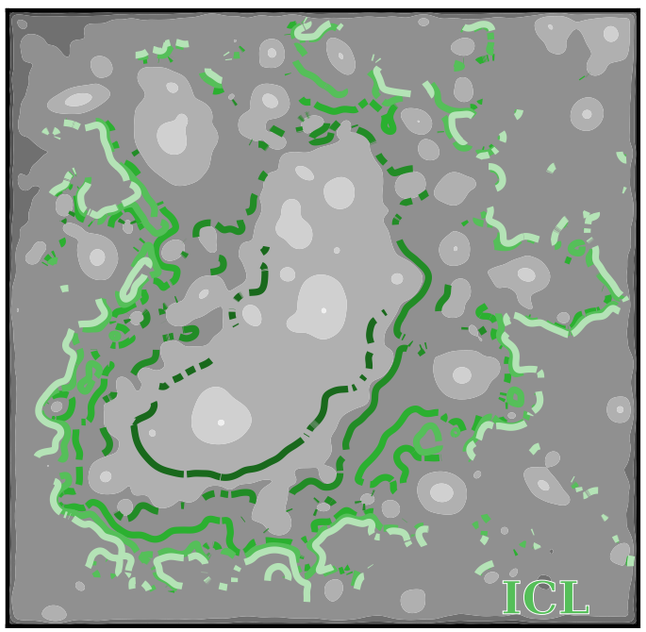
Detailed mass distribution within clusters!!

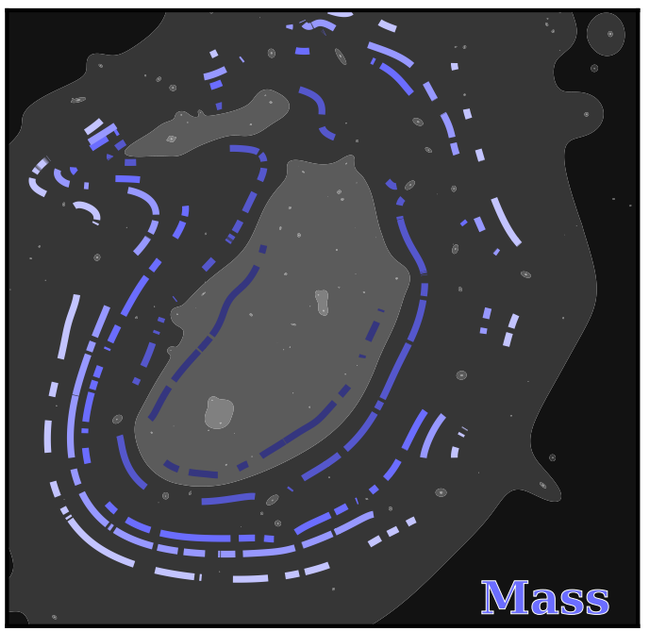
Total mass (Stellar + DM)

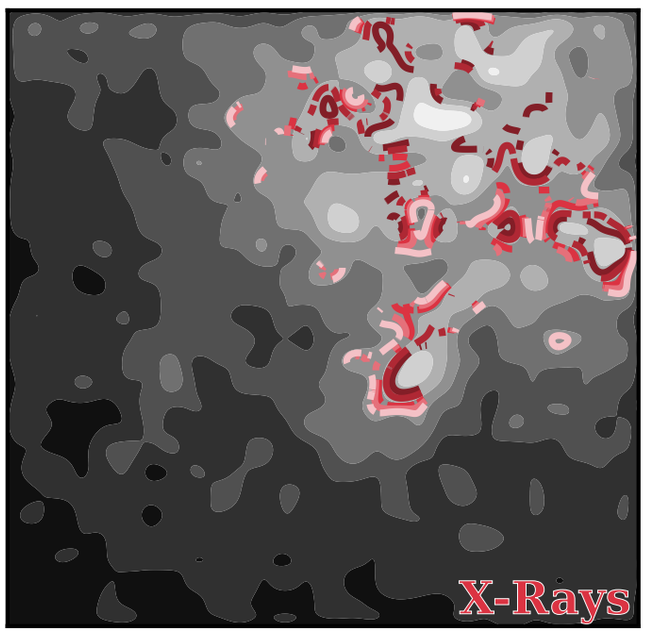
~10 mass models/cluster

Jauzac et al. (2014, 2015a)

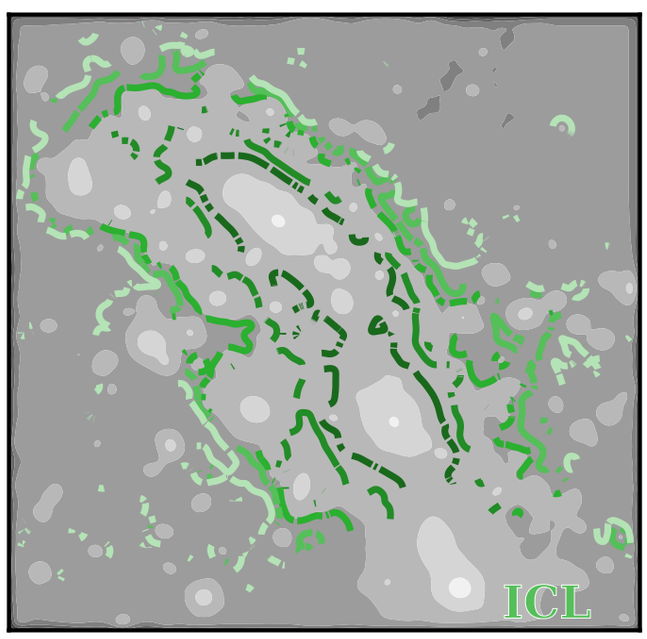
A2744

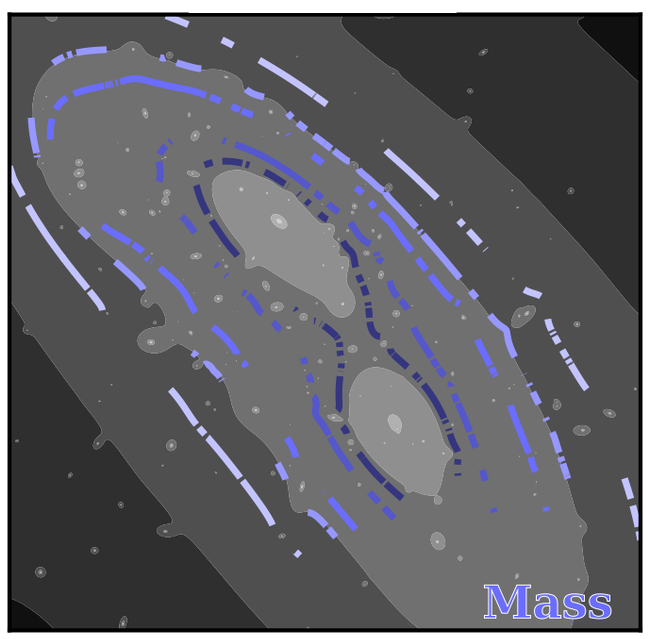


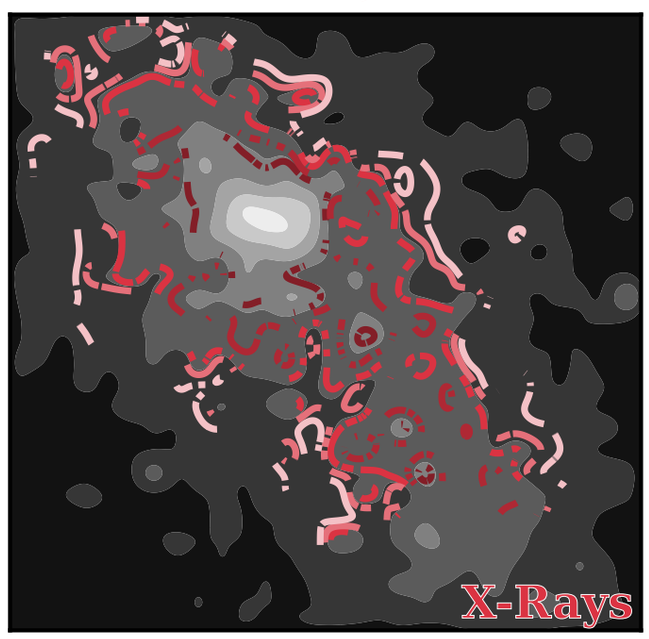




ICL **MASS** **X-rays**





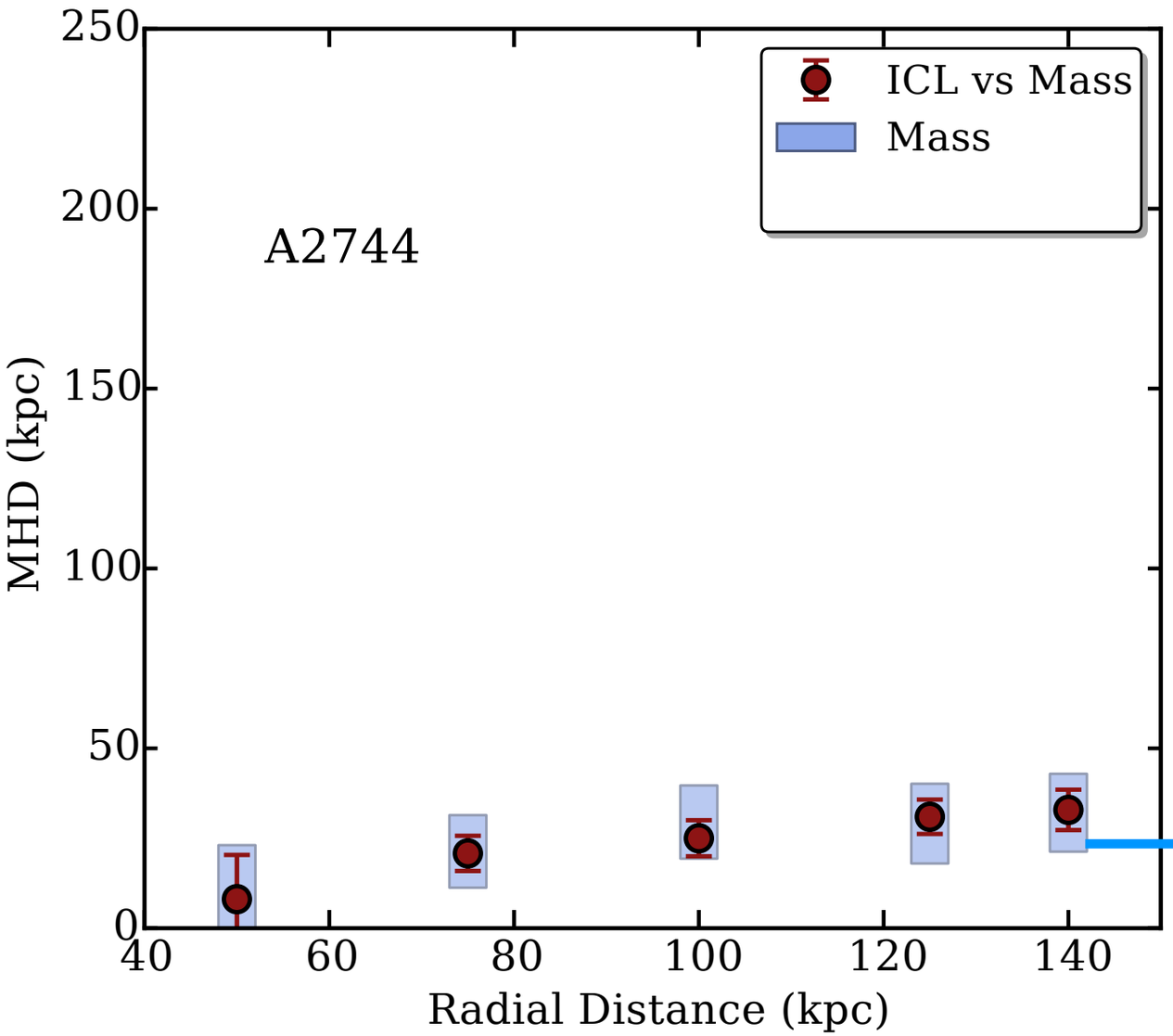


M0416

50 75 100 125 140 kpc

Modified Hausdorff Distance

mean difference in distance
between tracer and model, in kpc



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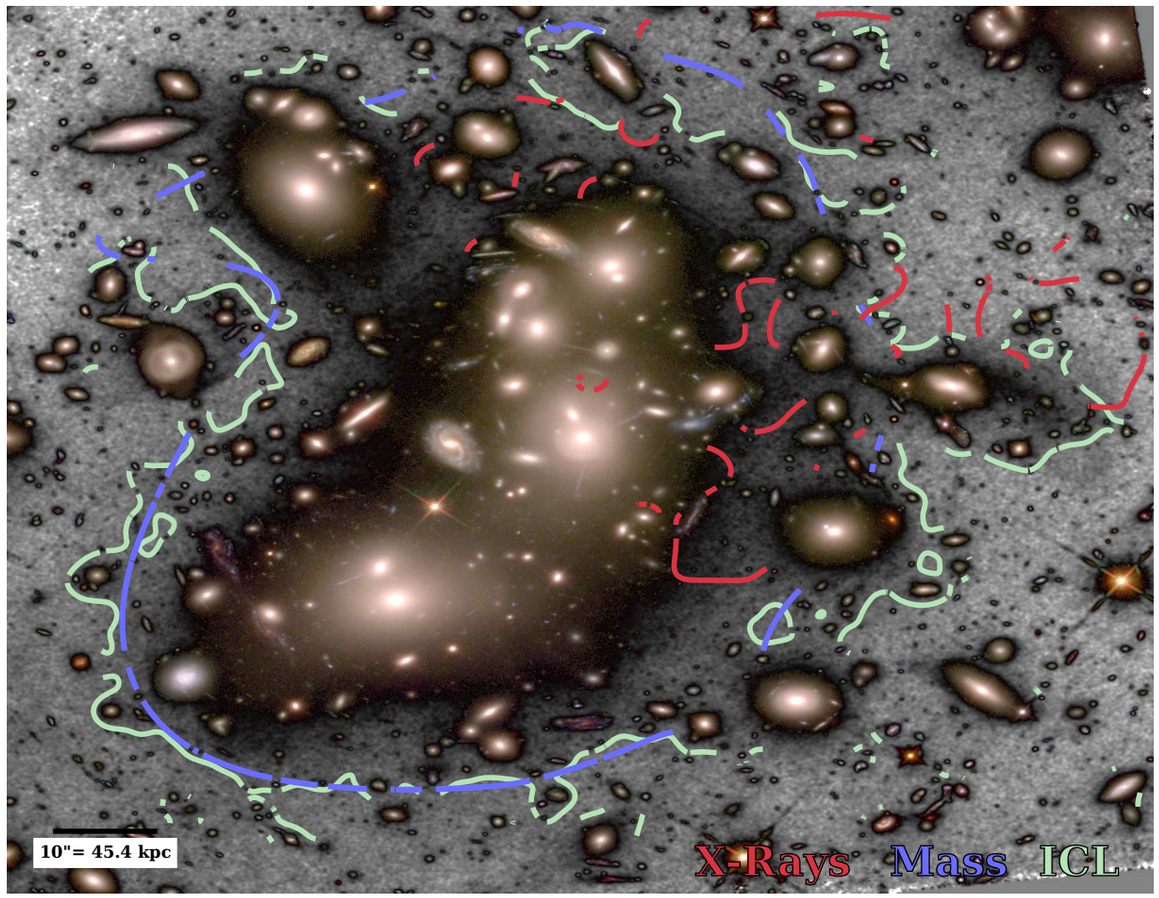


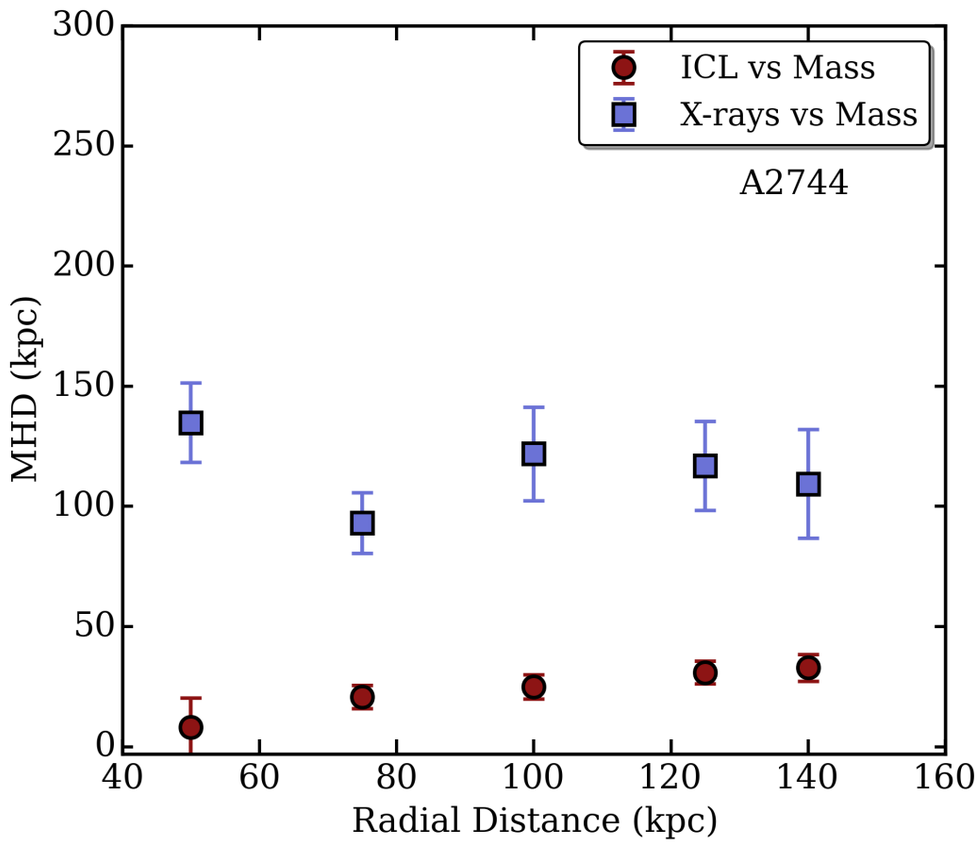
Different lens inversion techniques => uncertainties in the mass maps

Montes & Trujillo 2019

A2744

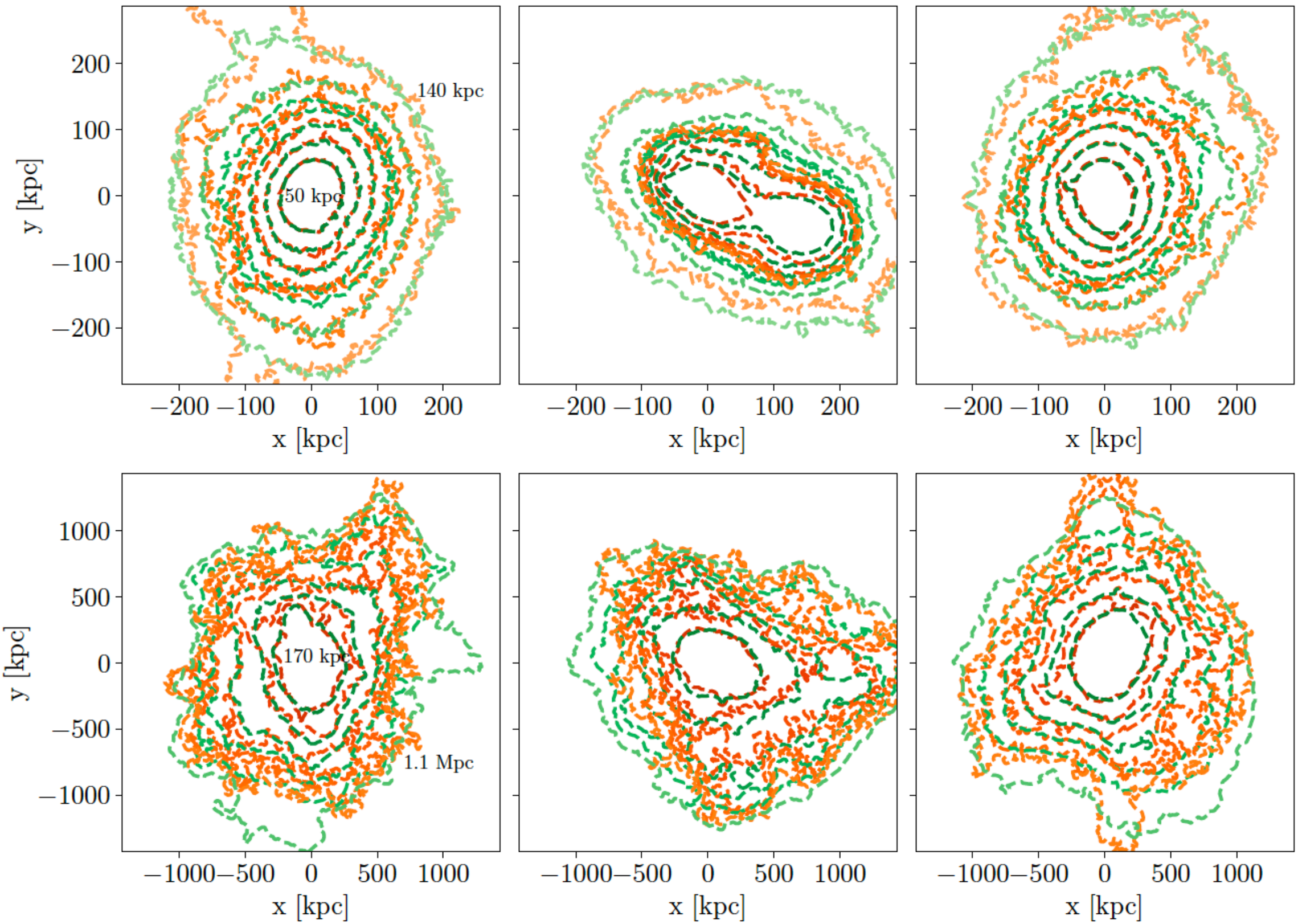
X-rays vs. **Mass**

Merging or recently merged clusters

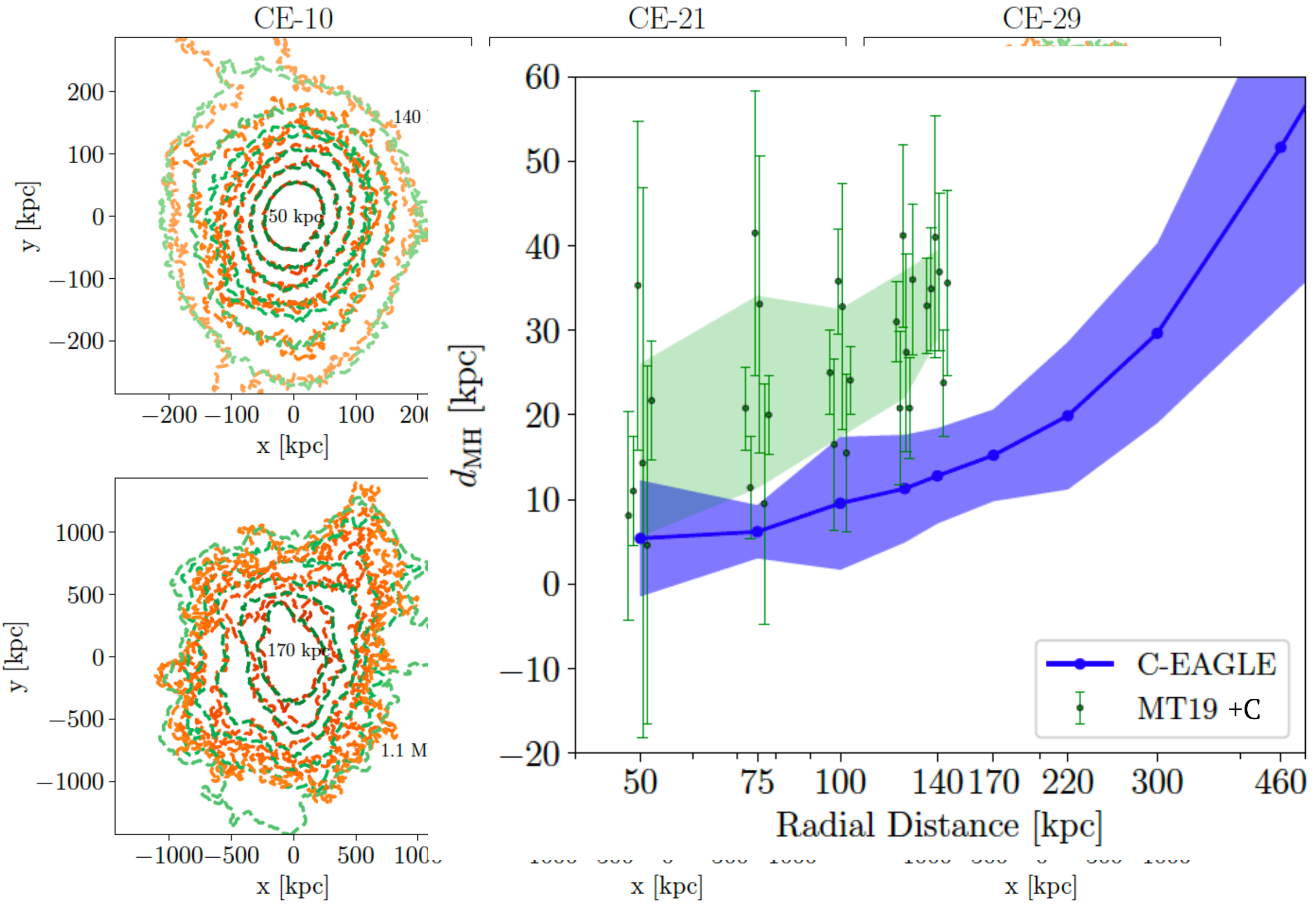


X-rays do not follow the potential of the cluster

Montes & Trujillo 2019



Alonso-Asensio, dalla Vecchia et al. in prep



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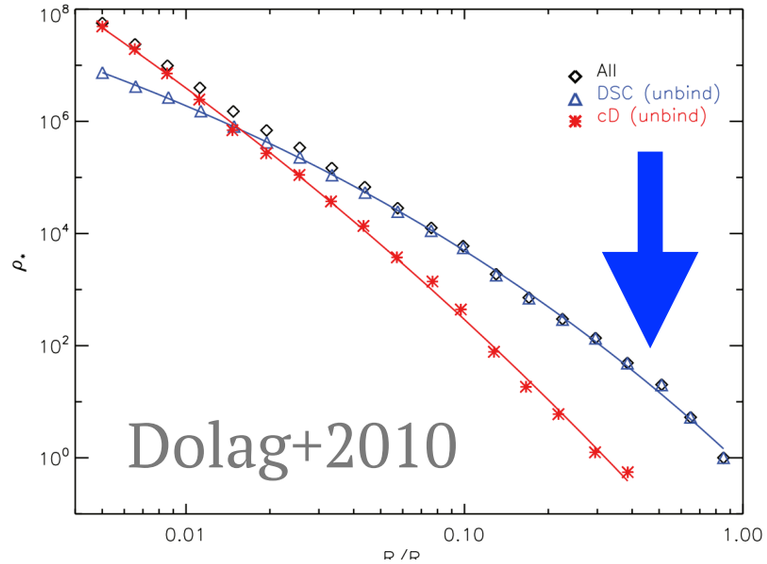
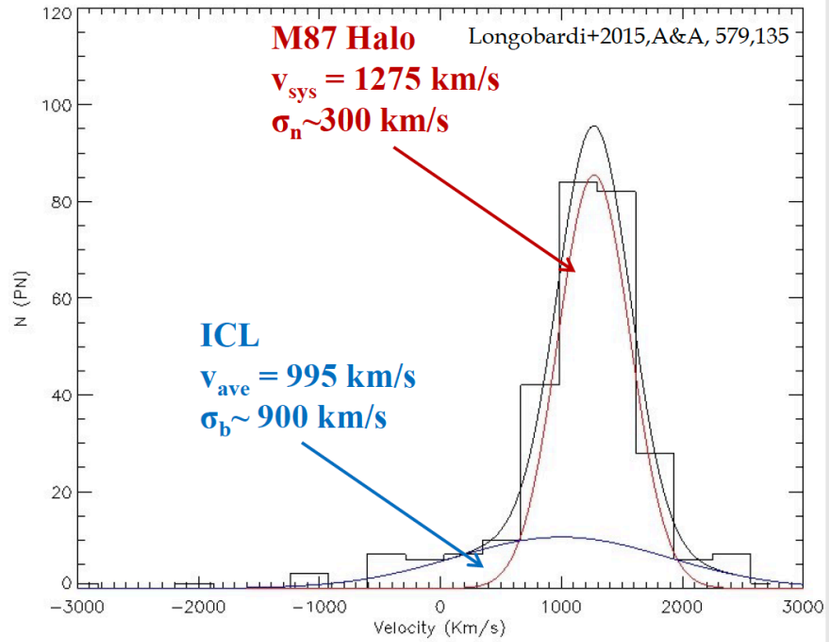
Massive halos are less concentrated
(Navarro+1996, Gao+2004)

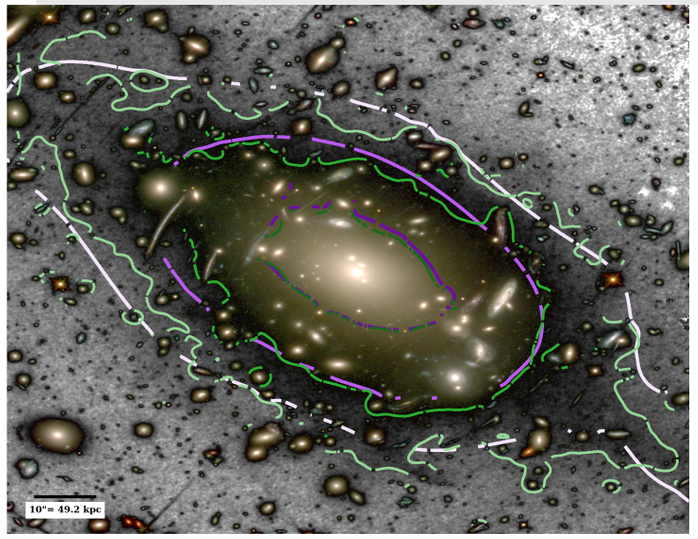
Their satellites tend to deposit their stars at large radii (Cooper+2015)



Those stars follow the potential of the cluster...

ICL tracer of DM!





see also Jee 2007b

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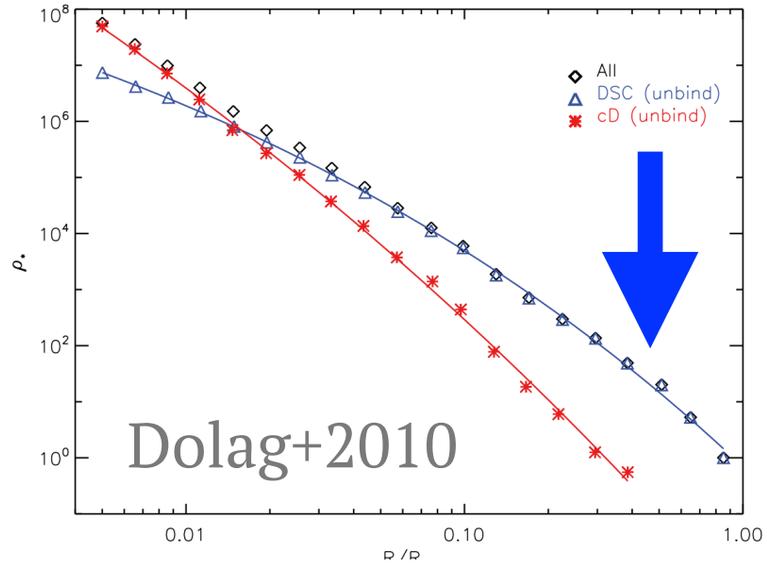

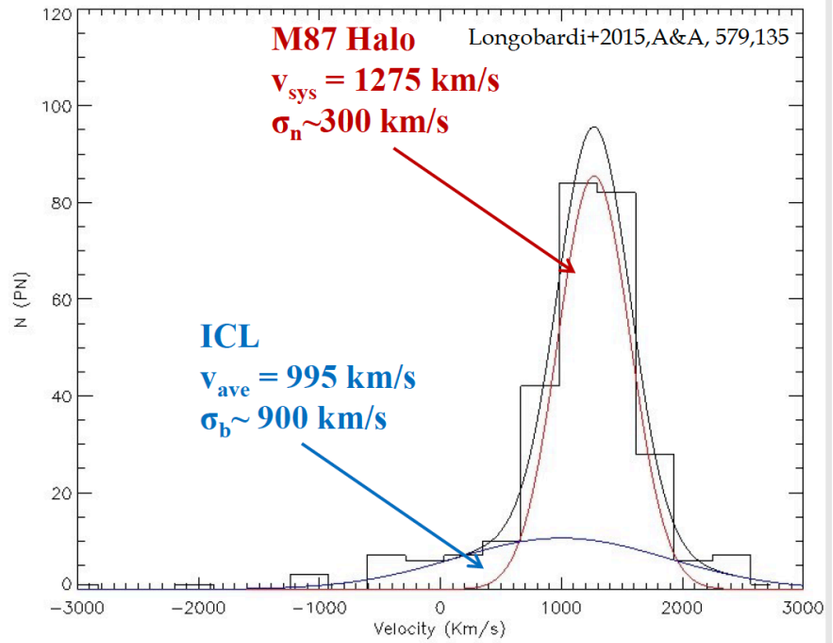

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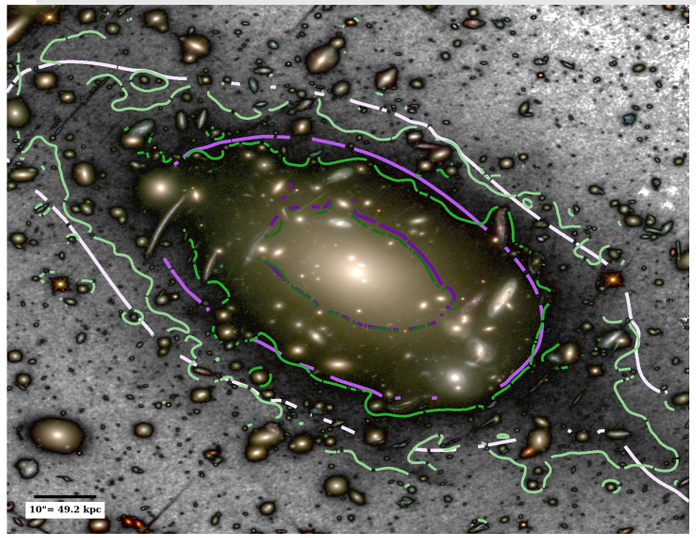
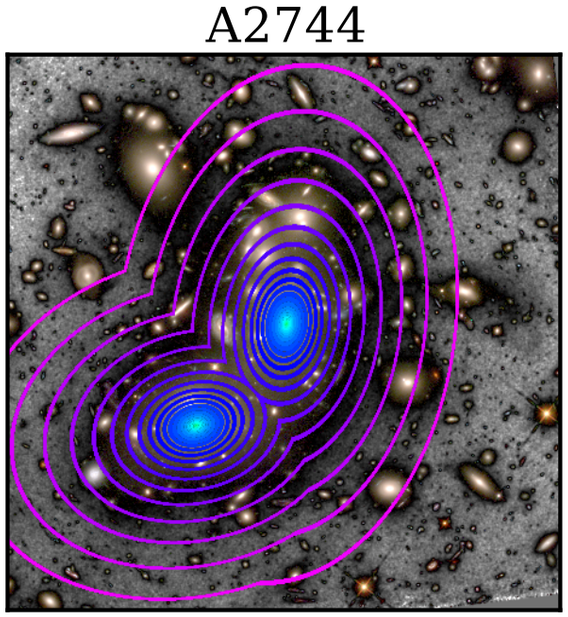


see also Jee 2007b


WOW
much ICL
such clusters
Thanks!

Extra slides...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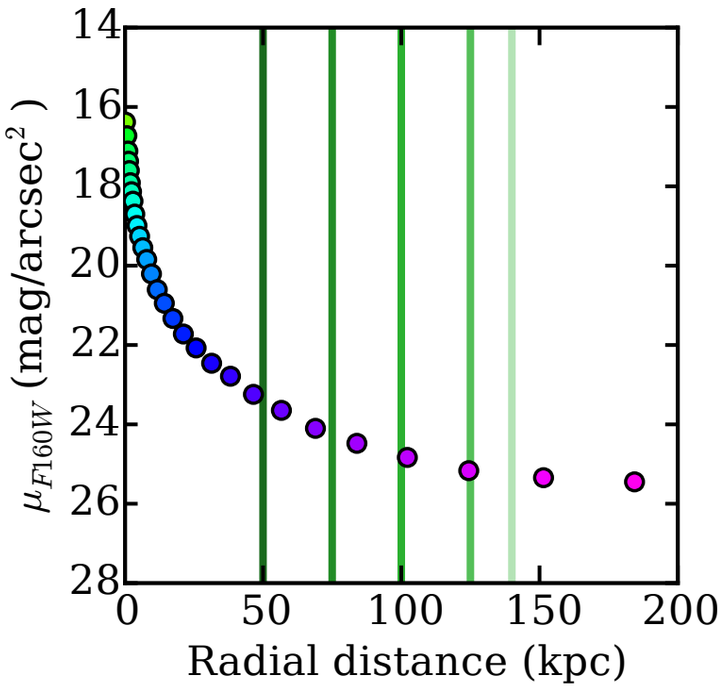
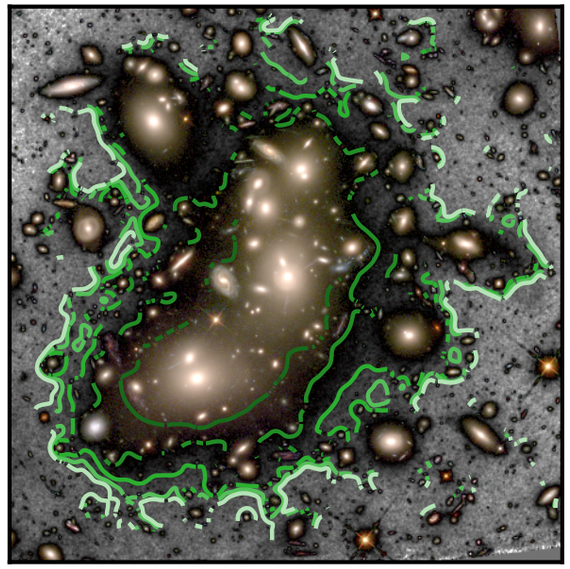

14
16
18
20
22
24
26
28
0
50
100
150
200
μ_{F160W} (mag/arcsec^2)
Radial distance (kpc)



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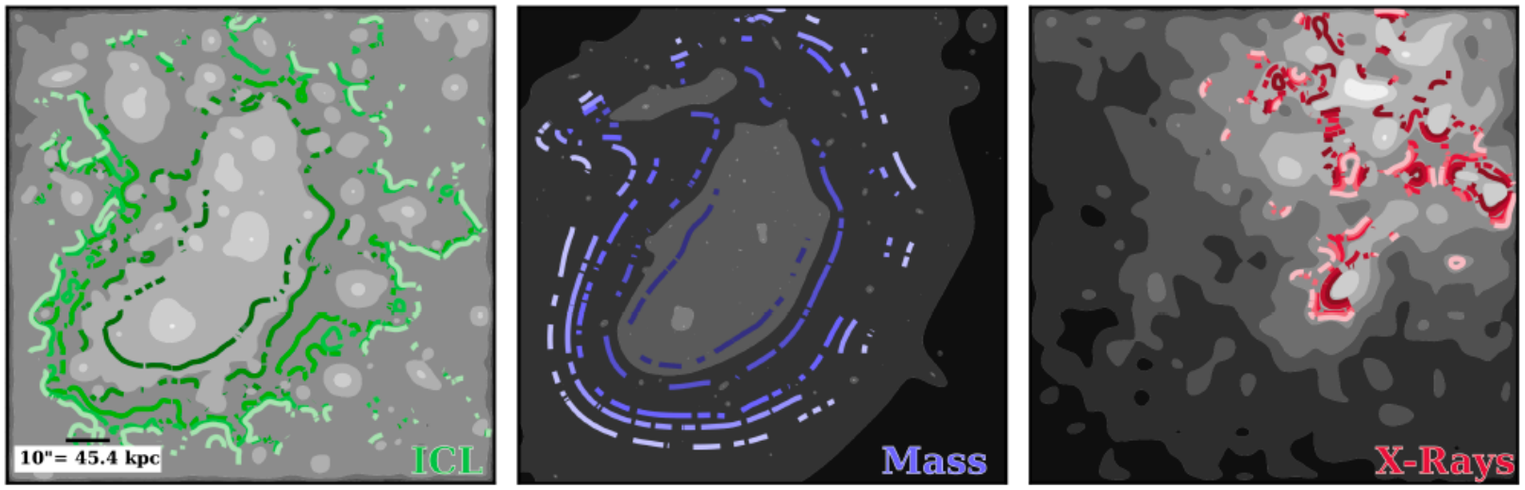
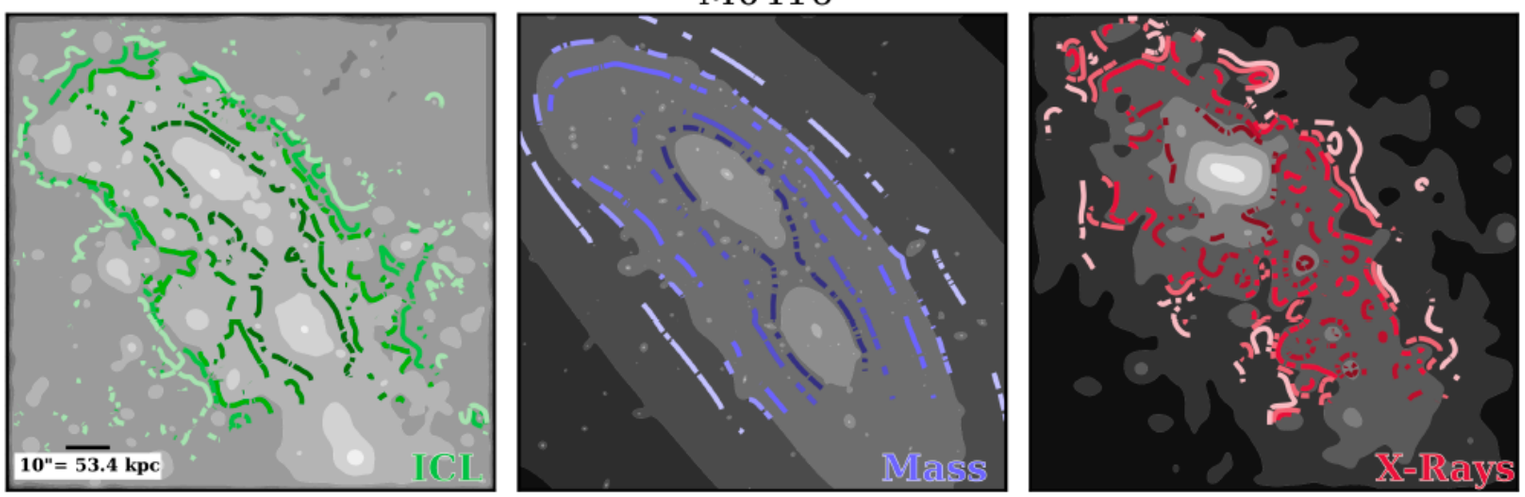
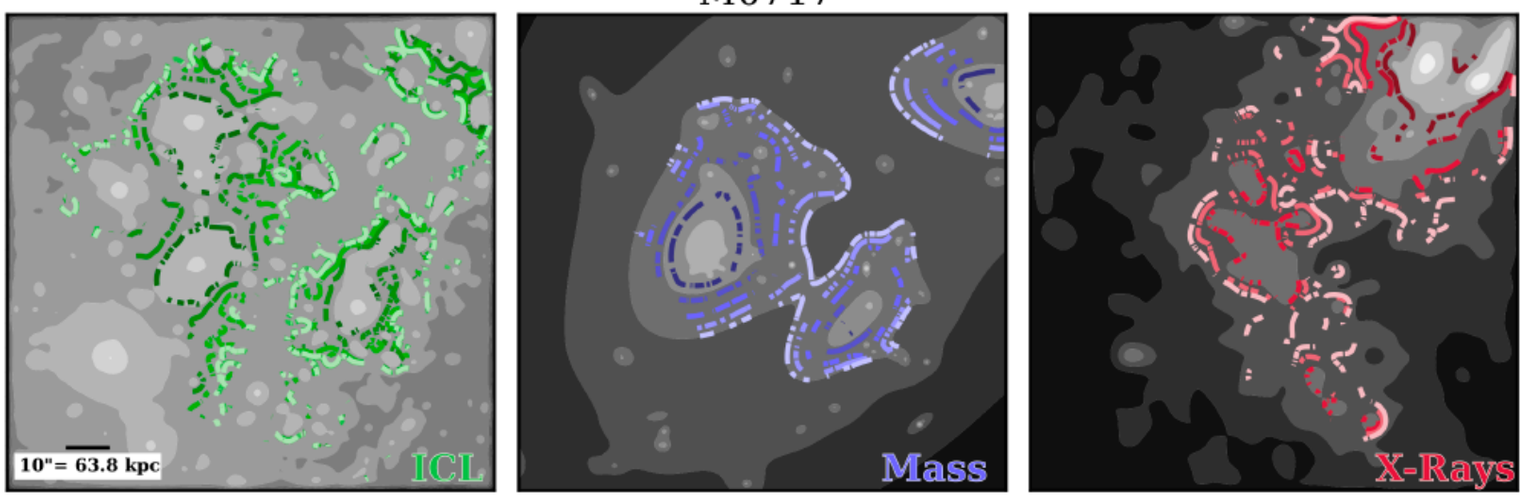


M0416



M0717



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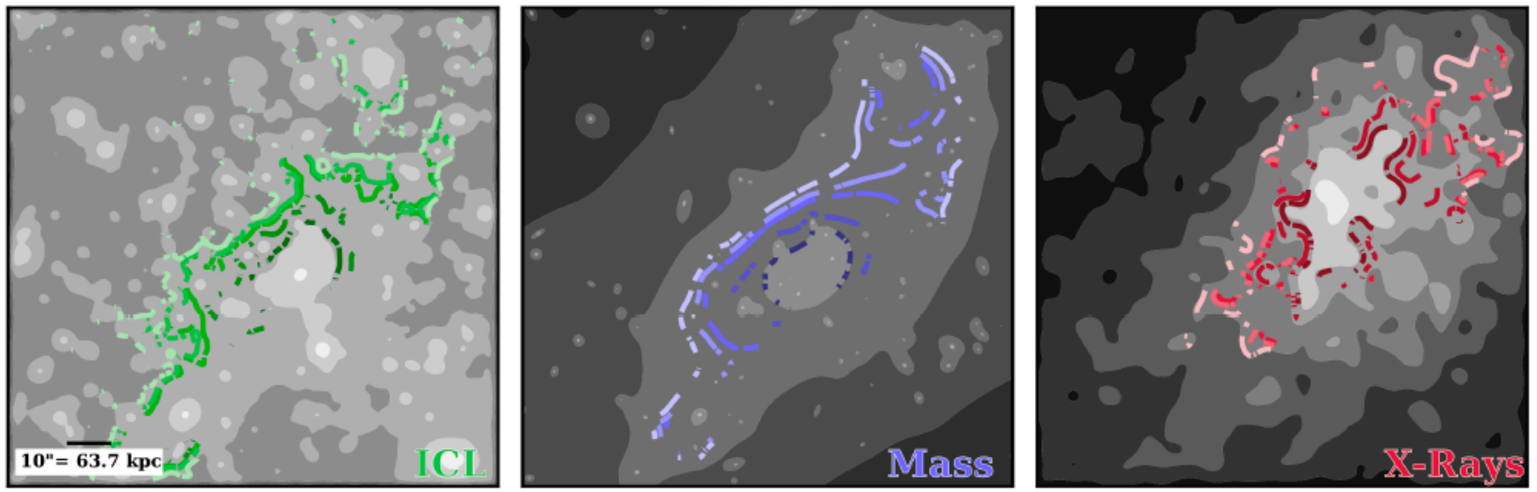

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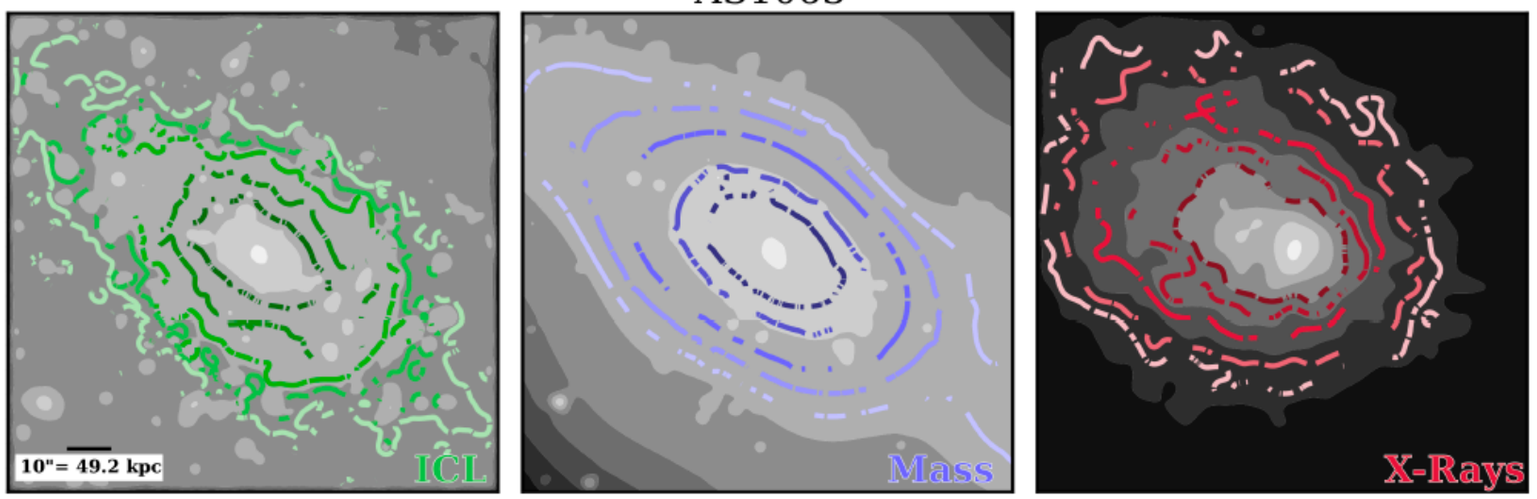

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